BRISTOL BAY SOCKEYE SALMON SPAWNING ESCAPEMENT TEST FISHING IN 1993

by

Barry L. Stratton

and

Drew L. Crawford

Regional Information Report[1] No. 2A96-02

Alaska Department of Fish and Game
Division of Commercial Fisheries Management and Development
Regional Office
333 Raspberry Road
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[1]Contribution 96-02 from the Anchorage regional office. The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate needs for up-to-date information, reports in this series may contain preliminary data.

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ABSTRACT

Drift gillnets were fished daily at two stations, or test fish sites, located on opposite river banks prior to every high slack tide in Kvichak, Egegik, Ugashik, and Igushik Rivers, Bristol Bay, Alaska, from mid-June to mid-July to estimate 1993 sockeye salmon spawning escapements. Accurate escapement estimates were made at counting towers. However, because it took sockeye salmon 1-6 d to reach tower sites after passing test fish sites, the test-fish projects provided fishery managers with preliminary escapement information. This early information enabled managers to better control commercial harvests and achieve escapement goals. The daily test-fish index for each river was the mean of catch per unit effort values obtained from all sets made the same day. Numbers of sockeye salmon that escaped the commercial fishery were estimated using (1) travel time analysis in which the most recent cumulative tower count was divided by cumulative test-fish indices and lagged back in time by daily increments, (2) a power curve (catchability model) calculated from mean length (independent variable) and escapement per index point (EPI) values from past years (dependent variable), and (3) the mean EPI value. Escapement estimates based on travel time for Kvichak, Egegik, Ugashik, and Igushik Rivers were more accurate and less biased than estimates based on catchability models or mean EPI values. However, catchability and mean EPI estimates were available on the first day of each project, whereas travel-time estimates could not be made until 5 d of test fishing data and tower counts were collected.

KEY WORDS: Sockeye salmon *Oncorhynchus nerka*, test fishing, spawning escapement estimation, fisheries management, Bristol Bay

INTRODUCTION

Test fishing in rivers by the Alaska Department of Fish and Game (ADF&G) is used in some areas to estimate numbers of salmon that have escaped commercial fishing districts and entered river systems to spawn; in Bristol Bay, river test fisheries are used to manage sockeye salmon *Oncorhynchus nerka* fisheries. Test-fishery data are available approximately 1 d after sockeye salmon have passed through the commercial fishing district and several days earlier than estimates based on visual counts from towers located at the head of the river systems. Spawning escapement estimates based on test-fish data assist management biologists in regulating commercial fishing periods to maximize harvests and achieve escapement goals. Test-fishing projects have been operated on Kvichak River since 1960, on Egegik River since 1963, on Ugashik River since 1961, and on Igushik River since 1976 (McBride 1978; Paulus 1965). This report summarizes test-fish data collected in 1993 and evaluates the accuracy of forecasting methods used during the 1993 season.

MATERIALS AND METHODS

Test Fishing

Two stations on opposite river banks were fished in the lower section of Kvichak, Egegik, Ugashik, and Igushik Rivers in 1993. Test-fish stations were close to the commercial fishing district boundary but above sockeye salmon milling areas. Stations fished at all four rivers have remained the same since 1987 (Fried and Bue 1988a).

Gillnets were drifted at all test-fish sites to estimate sockeye salmon abundance. All drifts were made perpendicular and close to shore because sockeye salmon migrate parallel to and near the river bank. Drifts at all stations were ended when about 30 sockeye were caught or when the inshore end of the net drifted about 25 m offshore and lost efficiency. Two short drifts of < 15 min duration were made at each Igushik River station about 1.5 h before every high slack tide for the entire season to minimize currents carrying the gillnet offshore. Two drifts were made at each station about 1.5 h before every high slack tide early in the season at Egegik and Ugashik Rivers. When the estimated sockeye escapement reached 10-15% of the point goal, only one drift was made at each station for the remainder of the year. One drift was made at each Kvichak River station about 1.5 h before every high slack tide for the entire season.

All gillnets were 45.7 m (150 ft or 25 fathoms) in length and 29 meshes deep. Monotwist

web, hung even with #50 twine and dyed Momoi shade #1, was used for test fishing on all rivers. Multistrand monofilament was used until 1989; however, this web type is now illegal for commercial use and is no longer stocked by suppliers. A stretched mesh size of 12.70 cm (5 in) was used on Kvichak River and 13.02 cm (5-1/8 in) was used on Egegik, Ugashik, and Igushik Rivers.

Catch per unit of effort (CPUE), or the number of sockeye salmon caught in 180 m (600 ft or 100 fathoms) of gillnet fished for 1 h, was calculated for each set. Most sockeye salmon captured during test fishing were sampled for sex and length data. At Igushik River most sockeye salmon test fish catches were sampled daily for age information whereas at Kvichak, Egegik, and Ugashik Rivers a maximum of 40 sockeye salmon were sampled daily for age information. At least 20-30% of these sockeye salmon were also weighed.

Climatological data was collected at all test fish camps. Observations were recorded for sky condition, wind velocity (km/h), wind direction, and water temperature (°C).

Data Analyses

Mean fishing time (MT), in minutes, was calculated for each set as

$$MT = SI - FO + \frac{(FO-SO) + (FI-SI)}{2}, \qquad (1)$$

where:

SO = time the gillnet first entered water,

FO = time the gillnet was fully deployed,

SI = time the gillnet retrieval began, and

FI = time the gillnet retrieval completed.

The CPUE value, C_j or the number of sockeye salmon caught per 100 fathom hours, was calculated for set j as follows:

$$C_j = 6{,}000 \frac{N}{G \times MT}, \qquad (2.1)$$

where:

N = number of sockeye salmon caught, and

G = gillnet length in fathoms.

Then the daily test fish index, I_i, for day i was calculated as the mean of individual CPUE values obtained from sets made the same day, or

$$I_i = \frac{\sum_{j=1}^{s} C_j}{s}, \qquad (2.2)$$

where

s = number of sets made during day i (usually four sets per day).

Weighted daily mean length and weight were calculated as

$$D_i = \frac{\sum_{j=1}^{s} S_j \times C_j}{\sum_{j=1}^{s} C_j}, \qquad (3.1)$$

where:

D_i = weighted daily mean length or weight for day i, and

S_j = mean length or weight for set j.

As new information became available weighted seasonal mean length and weight were recalculated daily:

$$M_i = \frac{\sum_{k=1}^{i} D_i \times I_i}{\sum_{k=1}^{i} I_i}, \qquad (3.2)$$

where:

M_i = weighted seasonal mean length or weight through day *i*, and

D_i = mean length or weight for day *i*.

Three methods were used to estimate daily spawning escapements: (1) travel-time (EPI_d), (2) a catchability model (EPI_m), and (3) mean EPI value (EPI_a).

Travel-time estimates of spawning escapements were based on the number of days it took sockeye salmon to travel from test fish sites to counting tower sites. A range of travel-time estimates was calculated by matching daily test-fish indices to daily tower counts. The number of sockeye salmon represented by each index point was calculated by dividing the most recent cumulative tower count by cumulative test-fish indices lagged back in time by daily increments such that

$$EPI_d = \frac{\sum_{i=1}^{t} E_i}{\sum_{i=1}^{t-d} I_i}, \qquad (4)$$

where:

EPI_d = number of sockeye salmon represented by each test fishing index point based on a travel-time of *d* days,

E_i = number of sockeye salmon traveling past counting tower on day *i*, and

t = day of most recent escapement estimate.

The best initial estimate of travel time produced the smallest squared sum of errors between daily cumulative test-fish indices and tower counts. However, travel times that seemed unrealistic based on results of past studies or produced unreasonable escapement estimates (e.g., less than observed escapement) were rejected even if they produced the best statistical fit to the data.

Total spawning escapement was then estimated as

$$\hat{E}_{t+d} = EPI_d \sum_{i=1}^{t} I_i, \qquad (5)$$

where

$\hat{E}_{t+d}$ = estimated number of sockeye salmon that will travel past counting tower on day $t+d$.

Catchability models were based on the relationship between weighted mean season length (independent variable) of sockeye salmon caught during test fishing and corresponding historical EPI values (dependent variable); these models were used to estimate daily spawning escapements in Egegik and Ugashik Rivers. The following power curve was used:

$$EPI_m = aM_i^b, \tag{6}$$

where

a and b = constants derived from a linear regression of 1979-1992 natural logarithm transformed data.

EPI estimates based on catchability models were not used if weighted mean lengths were outside of the range of data used to build models.

Total spawning escapement was then estimated as

$$\hat{E}_t = EPI_m \sum_{i=1}^{t} I_i, \tag{7}$$

where

$\hat{E}_t$ = estimated number of sockeye salmon to have traveled past test fish site by day t.

We assumed that changes in gillnet web type did not affect CPUE or mean size of sockeye salmon caught. A previous study by Bue (1986) found no obvious differences in fishing efficiency or sockeye salmon size selectivity between web types used in Bristol Bay.

For equation (7) mean EPI_a values of 111 for Kvichak, 72 for Egegik, and 49 for Ugashik Rivers were used based on results of the past eight years of test fishing (1985-1992); a mean EPI_a value of 51, based on results of 1988-1989 and 1991-1992 test fishing, was used for Igushik River (project not operated in 1990).

Estimates based on catchability models and mean EPI values were used to estimate escapements until estimates based on travel time became available. Travel time was preferred because it has usually provided more accurate escapement estimates (Stratton and Woolington 1992, Stratton and Crawford 1994). Also, when aerial surveys were flown,

escapement estimates made by management biologists were compared to test fishing estimates.

Three statistics were used to measure performance of the various escapement estimators. Percent error, PE, was used to measure daily performance:

$$PE = 100 \times \frac{T_{t,a} - \sum_{i=1}^{t+d} E_i}{\sum_{i=1}^{t+d} E_i}, \qquad (8)$$

where

$T_{t,a}$ = estimated cumulative spawning escapement on day t based on method a.

Mean percent error, MPE, was used to measure bias:

$$MPE = \sum_{t=1}^{n} \left(\frac{100 \times T_{t,a} - \sum_{i=1}^{t+d} E_i}{\sum_{i=1}^{t+d} E_i} \right), \qquad (9)$$

where

n = total number of days that escapement estimates based on test fishing were available

Mean absolute percent error, MAPE, was used to measure overall accuracy because it treated under- and over-estimation errors similarly:

$$MAPE = \sum_{t=1}^{n} \left| \left(100 \times \frac{T_{t,a} - \sum_{i=1}^{t+d} E_i}{\frac{\sum_{i=1}^{t+d} E_i}{n}} \right) \right| \qquad (10)$$

RESULTS AND DISCUSSION

Kvichak River

Test fishing began 22 June and ended 20 July. A total of 2,516 sockeye salmon were caught, producing 47,450 index points (Table 1; Appendix A.1). A total of 901 sockeye salmon were sampled for sex, age, and length information; 200 were weighed (Appendix A.2). Weighted mean weight and length for the season were 2.9 kg and 537 mm (Table 1; Appendix A.3).

Spawning escapement estimates for 22 to 25 June were based on the 1985-1992 mean EPI_a value of 111 (Table 2; Figure 1). Sufficient spawning escapement data was collected by 26 June to allow estimation of EPI_d values based on travel time (Table 3; Figure 2). Estimated travel times during the season ranged from 1 to 3 d. On the last day of project operation, the best estimate of travel time was 1 d.

Daily spawning escapement estimates based on the 1985-1992 mean EPI value ranged from 26% less to 326% greater than visual counts from towers, assuming actual travel time was 1 d (Table 2; Figure 1). Daily escapement estimates based on travel time ranged from 54% less to 28% greater than tower counts (Table 3; Figure 2).

When estimates for both methods were compared from 26 June through 20 July, estimates based on travel time analysis were more accurate (MAPE=10) and less biased (MPE=-1) than estimates based on the 1985-1992 mean EPI value (MAPE=24, MPE=24; Tables 2, 3; Figures 1, 2). 1985-1992 mean EPI value estimates were less accurate (MAPE=43) and more biased (MPE=40; Table 2) when all dates, 22 June through 20 July, were considered.

Estimated travel time on 20 July, the last day of the project, was 1 d. The cumulative tower count on 21 July was 4,007,712 sockeye salmon. The travel-time analysis estimate of 4,013,442 was slightly greater (< 1%), and the 1985-1992 mean EPI value estimate of 5,266,897 was 31% greater than the observed tower count.

Average water temperature during the project was 14°C while air temperatures averaged 17°C (Appendix A.4). High winds prevented completion of one drift on 26 June.

Egegik River

Test fishing began 15 June and ended 10 July. A total of 17,189 daily index points were produced from a catch of 1,566 sockeye salmon (Table 4; Appendix B.1). A total of 743

sockeye salmon were sampled for sex, age, and length data; 377 were sampled for weight (Appendix B.2). Weighted mean weight and length for the season were 2.8 kg and 551 mm (Table 4; Appendix B.3).

Sockeye salmon escapement estimates based on a catchability model and the 1985-1992 mean EPI_a value (72) were calculated as early as 15 June (Tables 5, 6; Figures 3, 4), and the average of the two estimates was used to estimate escapement from 15 to 22 June. Travel-time estimates were first available on 23 June (Table 7; Figure 5), and used to estimate escapements from 23 June until the end of the season. Estimated travel times ranged from 1 to 5 d during the season. On the last day of the season, the best travel time estimate was 1 d.

Assuming travel time was 1 d, daily escapement estimates based on catchability ranged from 65% less to 9,540% greater than visual counts from towers (Table 5; Figure 3). Daily escapement estimates based on the 1985-1992 mean EPI value ranged from 43% less to 15,832% greater than visual counts from towers (Table 6; Figure 4). Daily escapement estimates based on travel time ranged from 8% less to 61% greater than tower counts (Table 7; Figure 5).

When estimates for all methods were compared from 23 June through 10 July, estimates based on travel time analysis were more accurate (MAPE=16) and less biased (MPE=18) than estimates based on either 1985-1992 mean EPI value (MAPE=23, MPE=-23) or catchability (MAPE=53,MPE=-53; Tables 5-7; Figures 3-5). Both 1985-1992 mean EPI value and catchability estimates were less accurate (MAPE=750, 481) and more biased (MPE=712, 391) when all dates, 15 June through 10 July, were considered (Tables 5-6).

On 10 July, the last day of the project, estimated travel time was 1 d. The cumulative tower count on 11 July was 1,346,160 sockeye salmon. When compared to the observed tower count, the catchability estimate (781,456) was 42% lower, the 1985-1992 mean EPI value estimate (1,237,601) was 8% lower, and the travel time estimate (1,300,164) was 3% lower.

Average water temperature during the project was 12°C while air temperatures averaged 10°C (Appendix B.4). Although test-fishery project operations were not seriously hampered by weather conditions in 1993, six drifts were missed on 20 June when the skiff swamped.

Ugashik River

Test fishing began 24 June and ended 13 July. A total of 963 sockeye salmon were caught, producing 14,793 daily index points (Table 8; Appendix C.1). A total of 323 sockeye salmon were sampled for sex, age, and length data; 135 were weighed (Appendix C.2). Weighted mean length and weight of captured sockeye salmon for the season were 554 mm and 2.9

kg (Table 8; Appendix C.3).

Sockeye salmon escapement estimates based on a catchability model, the 1985-1992 mean EPI_a value (49), and travel time were used during the season to estimate spawning escapement (Tables 9-11; Figures 6-8). Abundance estimates based on the 1985-1992 mean EPI value and catchability were made as early as 24 June. Travel-time estimates were first available on 2 July. Estimated travel-times during the season ranged from 1 to 3 d. On the last day of the season, the best estimate of travel time was 2 d.

Assuming travel time was 2 d, escapement estimates from the catchability model ranged from 64% less to 7,050% greater than tower counts (Table 9; Figure 6). Estimates based on the 1985-1992 mean EPI value ranged from 44% less to 6,967% greater than tower counts (Table 10; Figure 7). Travel-time estimates ranged from 69% less to 170% greater than tower counts (Table 11; Figure 8). Catchability estimates and the 1985-1992 mean EPI value estimates were higher than tower counts from 24 June through 5 July, then lower for the remainder of the season.

When estimates for all methods were compared from 24 June through 13 July, estimates based on travel time analysis were more accurate (MAPE=40) and less biased (MPE=12) than estimates based on either 1985-1992 mean EPI value (MAPE=70, MPE=16) or catchability (MAPE=62, MPE=-20; Tables 9-11; Figures 6-8). Both 1985-1992 mean EPI value and catchability estimates were less accurate (MAPE=543, 509) and more biased (MPE=506, 454) when all dates, 24 June through 13 July, were considered (Tables 8-9).

On the last day of the project, estimated travel time was 2 d. The cumulative tower count on 15 July was 1,292,046 sockeye salmon. When compared to the observed tower count, the 1985-1992 mean EPI value estimate (724,874) was 44% lower, the catchability estimate (466,103) was 64% lower, and the travel-time estimate (1,290,080) was similar.

The average air and water temperatures during the project were 13°C (Appendix C.4). Test-fishery project operations were not hampered by weather in 1993.

Igushik River

Test fishing began 18 June and ended 11 July. A total of 187 sockeye salmon were caught, producing 511 daily index points (Table 12; Appendix D.1). A total of 141 sockeye salmon were sampled for sex, age, and length data; 118 were weighed (Appendix D.2). Weighted mean length and weight of captured sockeye salmon for the season were 550 mm and 3.3 kg (Table 12; Appendix D.3).

Sockeye salmon escapement estimates based on the 1988-1989 and 1991-1992 mean EPI_a

value (51) and travel time (EPI_d) were used during the season to estimate spawning escapement (Tables 13-14; Figures 9-10). An abundance estimate based on the 1988-1989 and 1991-1992 mean EPI value was made as early as 19 June. Travel-time estimates were first available on 26 June. Estimated travel-times during the season ranged from 2 to 6 d. On the last day of the season, the best estimate of travel time was 6 d.

Estimates based on the 1988-1989 and 1991-1992 mean EPI value ranged from 85% to 96% less than tower counts (Table 13; Figure 9). Travel-time estimates ranged from 79% less to 62% greater than tower counts (Table 14; Figure 10). Accuracy of travel-time analysis estimates increased during the season. The 1988-1989 and 1991-1992 mean EPI value greatly underestimated the 1993 escapement.

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Table 1. Sockeye salmon spawning escapement test-fishing data summary, Kvichak River, 1993.

Date	Fishing Time (min)	Catch (no)	Index	Cumulative Index	Daily Mean Weight (kg)	Daily Mean Length (mm)	Weighted Season Mean Weight	Weighted Season Mean Length
6/22	42.2	23	162	162	2.6	563	2.6	563
6/23	32.2	9	73	235	2.8	560	2.7	562
6/24	31.3	75	1,562	1,797	2.6	547	2.6	548
6/25	21.8	81	2,859	4,656	2.7	535	2.7	540
6/26[a]	21.4	59	970	5,626	2.6	547	2.7	541
6/27	16.7	123	2,050	7,676	2.6	550	2.8	543
6/28	31.3	44	487	8,163	2.6	537	2.8	543
6/29	13.2	49	1,027	9,190	3.3	550	2.8	543
6/30	35.2	64	427	9,617	3.2	545	2.9	543
7/01	27.8	89	1,398	11,015	3.1	542	2.9	543
7/02	31.4	143	1,365	12,380	2.8	545	2.9	543
7/03	15.2	127	2,406	14,786	3.3	536	3.0	542
7/04	8.4	162	4,755	19,541	3.0	528	3.0	538
7/05	19.0	158	3,245	22,786	3.1	532	3.0	537
7/06	21.6	144	2,408	25,194	3.1	534	3.0	536
7/07	18.8	131	2,058	27,252	2.9	544	3.0	537
7/08	19.8	148	2,907	30,159	3.0	534	3.0	537
7/09	16.2	158	4,232	34,391	3.0	539	3.0	537
7/10	20.4	132	2,713	37,104	2.8	545	3.0	537
7/11	11.6	150	4,635	41,739	2.8	521	3.0	536
7/12	27.0	64	906	42,645	2.6	534	3.0	536
7/13	16.3	20	386	43,031	2.8	533	3.0	536
7/14	35.3	59	404	43,435	2.4	525	3.0	536
7/15	31.8	92	809	44,244	2.6	533	3.0	536
7/16	28.0	79	1,263	45,507	2.8	542	3.0	536
7/17	18.0	45	847	46,354	2.4	544	2.9	536
7/18	21.4	33	471	46,825	2.4	540	2.9	537
7/19	29.1	36	423	47,248	2.3	538	2.9	537
7/20	28.1	19	202	47,450	2.5	539	2.9	537

[a] High winds prevented crew from completing pm drift at Station #2.

Table 2. Comparison of sockeye salmon spawning escapement estimates based on mean EPI value (1985–1992: EPI=111) for test-fishing data and visual counts from observation towers, Kvichak River, 1993.

Test Fishing		Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Cumulative Number of Sockeye Salmon	Date Plus Travel Time[a]	Cumulative Number of Sockeye Salmon	
6/22	18,021	6/23	24,366	−26
6/23	26,064	6/24	34,194	−24
6/24	199,451	6/25	51,342	288
6/25	516,834	6/26	121,254	326
6/26	624,523	6/27	316,566	97
6/27	852,077	6/28	558,960	52
6/28	906,099	6/29	846,684	7
6/29	1,020,135	6/30	931,620	10
6/30	1,067,484	7/01	1,013,760	5
7/01	1,222,674	7/02	1,081,356	13
7/02	1,374,228	7/03	1,182,366	16
7/03	1,641,219	7/04	1,306,998	26
7/04	2,169,064	7/05	1,678,014	29
7/05	2,529,279	7/06	2,372,136	7
7/06	2,796,495	7/07	2,732,874	2
7/07	3,024,949	7/08	2,931,708	3
7/08	3,347,609	7/09	3,101,490	8
7/09	3,817,424	7/10	3,264,420	17
7/10	4,118,515	7/11	3,402,450	21
7/11	4,633,044	7/12	3,573,750	30
7/12	4,733,570	7/13	3,750,978	26
7/13	4,776,417	7/14	3,818,466	25
7/14	4,821,286	7/15	3,864,336	25
7/15	4,911,074	7/16	3,893,586	26
7/16	5,051,273	7/17	3,920,664	29
7/17	5,145,301	7/18	3,957,924	30
7/18	5,197,552	7/19	3,986,076	30
7/19	5,244,503	7/20	3,996,378	31
7/20	5,266,897	7/21	4,007,712	31
6/22–7/20			Mean Percent Error (MPE)	40
			Mean Absolute Percent Error (MAPE)	43
6/26–7/20			Mean Percent Error (MPE)	24
			Mean Absolute Percent Error (MAPE)	24

[a] Best travel-time estimate at end of season was 1 d.

Table 3. Comparison of sockeye salmon spawning escapement estimates based on travel-time analysis of test-fishing data and visual counts from observation towers, Kvichak River, 1993.

Test Fishing				Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Travel Time (d)	EPI Value	Cumulative Number of Sockeye Salmon	Date Plus Travel Time	Cumulative Number of Sockeye Salmon	
6/26	1	26	146,518	6/27	316,566	−54
6/27	2	67	521,905	6/29	846,684	−38
6/28	3	120	979,952	7/01	1,013,760	− 3
6/29	3	150	1,383,026	7/02	1,081,356	28
6/30	3	121	1,167,134	7/03	1,182,366	− 1
7/01	3	124	1,367,948	7/04	1,306,998	5
7/02	2	112	1,392,086	7/04	1,306,998	7
7/03	3	122	1,817,846	7/06	2,372,136	−23
7/04	2	105	2,062,949	7/06	2,372,136	−13
7/05	2	113	2,585,984	7/07	2,732,874	− 5
7/06	2	121	3,058,308	7/08	2,931,708	4
7/07	2	119	3,268,443	7/09	3,101,490	5
7/08	2	116	3,509,468	7/10	3,264,420	8
7/09	2	113	3,914,016	7/11	3,402,450	15
7/10	2	108	4,016,168	7/12	3,573,750	12
7/11	1	91	3,827,520	7/12	3,573,750	7
7/12	2	96	4,107,449	7/14	3,818,466	8
7/13	1	87	3,784,930	7/14	3,818,466	− 1
7/14	1	88	3,854,336	7/15	3,864,336	0
7/15	1	88	3,936,302	7/16	3,893,586	1
7/16	1	88	4,004,738	7/17	3,920,664	2
7/17	1	86	3,993,646	7/18	3,957,924	1
7/18	1	85	3,998,116	7/19	3,986,076	0
7/19	1	85	4,022,083	7/20	3,996,378	1
7/20	1	84	4,013,442	7/21	4,007,712	0
6/26–7/20					Mean Percent Error (MPE)	− 1
					Mean Absolute Percent Error (MAPE)	10

Table 4. Sockeye salmon spawning escapement test-fishing data summary, Egegik River, 1993.

Date	Fishing Time (min)	Catch (no)	Index	Cumulative Index	Daily Mean Weight (kg)	Daily Mean Length (mm)	Weighted Season Mean Weight	Weighted Season Mean Length
6/15	40.3	49	298	298	2.8	546	2.8	545
6/16	51.4	36	166	464	2.6	566	2.8	553
6/17	38.9	93	763	1,227	3.0	555	2.9	553
6/18	47.3	137	738	1,965	2.7	553	2.8	553
6/19	41.5	154	948	2,913	3.0	557	2.9	554
6/20[a]	9.0	41	1,066	3,979	2.9	535	2.9	553
6/21	45.7	56	416	4,395	2.9	542	2.9	551
6/22	26.6	4	36	4,431	2.3	519	2.9	551
6/23	24.6	7	70	4,501	2.5	539	2.9	551
6/24	24.2	74	766	5,267	3.1	555	2.9	551
6/25	25.3	48	511	5,778	3.1	558	2.9	552
6/26	24.7	167	2,083	7,861	3.0	551	2.9	551
6/27	23.6	30	315	8,176	3.1	568	2.9	552
6/28	25.8	19	170	8,346	2.6	552	2.9	552
6/29	29.0	27	226	8,572	3.1	572	2.9	552
6/30	13.8	6	97	8,669	2.6	519	2.9	552
7/01	31.7	45	284	8,953	2.9	570	2.9	553
7/02	24.1	37	425	9,378	3.0	584	2.9	554
7/03	23.8	59	789	10,167	3.1	568	3.0	554
7/04	24.2	34	336	10,503	2.6	542	2.9	554
7/05	19.3	112	1,782	12,285	2.9	547	2.9	553
7/06	15.1	110	1,769	14,054	2.6	546	2.9	552
7/07	13.8	84	1,543	15,597	2.5	544	2.9	552
7/08	21.7	75	878	16,475	2.3	545	2.8	551
7/09	26.7	48	503	16,978	2.6	566	2.8	551
7/10	15.7	14	211	17,189	2.3	510	2.8	551

[a] Four morning drifts and two evening drifts missed due to skiff swamping.

Table 5. Comparison of sockeye salmon spawning escapement estimates based on catchability analysis of test-fishing data and visual counts from observation towers, Egegik River, 1993.

Test Fishing		Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Cumulative Number of Sockeye Salmon[a]	Date Plus Travel Time[b]	Cumulative Number of Sockeye Salmon	
6/15	15,022	6/16	[c]	
6/16	20,369	6/17	[c]	
6/17	52,894	6/18	[c]	
6/18	85,602	6/19	888	9,540
6/19	123,910	6/20	21,342	481
6/20	174,676	6/21	152,184	15
6/21	197,587	6/22	296,622	-33
6/22	199,860	6/23	452,814	-56
6/23	203,487	6/24	551,532	-63
6/24	236,397	6/25	620,784	-62
6/25	257,635	6/26	731,298	-65
6/26	352,783	6/27	776,544	-55
6/27	363,633	6/28	796,212	-54
6/28	371,290	6/29	803,244	-54
6/29	378,400	6/30	811,536	-53
6/30	383,752	7/01	838,584	-54
7/01	393,032	7/02	887,556	-56
7/02	403,204	7/03	907,440	-56
7/03	430,262	7/04	932,016	-54
7/04	447,380	7/05	1,002,558	-55
7/05	531,917	7/06	1,105,728	-52
7/06	617,771	7/07	1,167,420	-47
7/07	695,157	7/08	1,215,660	-43
7/08	738,763	7/09	1,253,484	-41
7/09	768,569	7/10	1,284,222	-40
7/10	781,456	7/11	1,346,160	-42
6/15-7/10			Mean Percent Error (MPE)	391
			Mean Absolute Percent Error (MAPE)	481
6/23-7/10			Mean Percent Error (MPE)	- 53
			Mean Absolute Percent Error (MAPE)	53

[a] Catchability model was: $EPI_m = (9.175 \times 10^{30}) M_i^{-10.690}$ where M_i = weighted mean length (Stratton and Crawford 1994).

[b] Best travel-time estimate at end of season was 1 d.

[c] Observation towers not in operation.

Table 6. Comparison of sockeye salmon spawning escapement estimates based on mean EPI value (1985–1992: EPI=72) for test-fishing data and visual counts from observation towers, Egegik River, 1993.

Test Fishing		Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Cumulative Number of Sockeye Salmon	Date Plus Travel Time[a]	Cumulative Number of Sockeye Salmon	
6/15	21,449	6/16	[c]	
6/16	33,380	6/17	[c]	
6/17	88,354	6/18	[c]	
6/18	141,480	6/19	888	15,832
6/19	209,750	6/20	21,342	883
6/20	286,517	6/21	152,184	88
6/21	316,429	6/22	296,622	7
6/22	319,045	6/23	452,814	−30
6/23	324,051	6/24	551,532	−41
6/24	379,207	6/25	620,784	−39
6/25	416,032	6/26	731,298	−43
6/26	565,981	6/27	776,544	−27
6/27	588,674	6/28	796,212	−26
6/28	600,943	6/29	803,244	−25
6/29	617,192	6/30	811,536	−24
6/30	624,170	7/01	838,584	−26
7/01	644,641	7/02	887,556	−27
7/02	675,183	7/03	907,440	−26
7/03	732,026	7/04	932,016	−21
7/04	756,247	7/05	1,002,558	−25
7/05	884,515	7/06	1,105,728	−20
7/06	1,011,875	7/07	1,167,420	−13
7/07	1,122,945	7/08	1,215,660	− 8
7/08	1,186,194	7/09	1,253,484	− 5
7/09	1,222,426	7/10	1,284,222	− 5
7/10	1,237,601	7/11	1,346,160	− 8
6/15–7/10			Mean Percent Error (MPE)	712
			Mean Absolute Percent Error (MAPE)	750
6/23–7/10			Mean Percent Error (MPE)	− 23
			Mean Absolute Percent Error (MAPE)	23

[a] Best travel-time estimate at end of season was 1 d.

[b] Observation towers not in operation

Table 7. Comparison of sockeye salmon spawning escapement estimates based on travel-time analysis of test-fishing data and visual counts from observation towers, Egegik River, 1993.

Test Fishing				Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Travel Time (d)	EPI Value	Cumulative Number of Sockeye Salmon	Date Plus Travel Time	Cumulative Number of Sockeye Salmon	
6/23	5	230	1,037,140	6/28	796,212	30
6/24	4	138	729,954	6/28	796,212	- 8
6/25	4	141	816,189	6/29	803,244	2
6/26	4	165	1,297,311	6/30	811,536	60
6/27	5	175	1,432,811	7/02	887,556	61
6/28	4	151	1,261,786	7/02	887,556	42
6/29	2	98	842,155	7/01	838,584	0
6/30	2	97	842,902	7/02	887,556	- 5
7/01	2	97	875,880	7/03	907,440	- 3
7/02	2	102	960,094	7/04	932,016	3
7/03	2	101	1,030,448	7/05	1,002,558	3
7/04	2	99	1,043,916	7/06	1,105,728	- 6
7/05	3	106	1,313,389	7/08	1,215,660	8
7/06	3	108	1,528,440	7/09	1,253,484	22
7/07	3	111	1,733,491	7/10	1,284,222	35
7/08	4	115	1,906,795	7/12	1,388,292	37
7/09	1	76	1,291,771	7/10	1,284,222	1
7/10	1	75	1,300,164	7/11	1,346,160	- 3
6/23-7/10					Mean Percent Error (MPE)	16
					Mean Absolute Percent Error (MAPE)	18

Table 8. Sockeye salmon spawning escapement test-fishing data summary, Ugashik River, 1993.

Date	Fishing Time (min)	Catch (no)	Index	Cumulative Index	Daily Mean Weight (kg)	Daily Mean Length (mm)	Weighted Season Mean Weight	Weighted Season Mean Length
6/24	61.6	1	4	4	1.5	510	1.5	510
6/25	117.2	5	9	13	2.7	544	2.4	537
6/26	110.9	2	4	17	2.1	502	2.3	527
6/27	108.2	3	7	24	2.2	530	2.3	528
6/28	110.6	4	9	33	3.0	552	2.5	535
6/29	111.0	9	20	53	2.9	578	2.6	551
6/30	53.5	7	31	84	2.7	562	2.7	554
7/01	102.1	10	22	106	2.8	552	2.7	553
7/02	115.9	14	26	132	2.6	544	2.7	551
7/03	110.7	31	68	200	2.5	541	2.6	547
7/04	111.4	18	39	239	2.4	537	2.6	545
7/05	116.6	47	96	335	2.8	549	2.6	546
7/06	48.4	162	1,561	1,896	3.0	552	2.9	550
7/07	9.8	212	5,877	7,773	3.1	563	3.0	559
7/08	24.8	209	4,376	12,149	2.6	545	2.9	554
7/09	21.2	100	1,937	14,086	2.8	555	2.9	554
7/10	45.9	61	407	14,493	2.7	547	2.9	554
7/11	56.1	41	177	14,670	2.6	548	2.9	554
7/12	53.1	11	50	14,720	2.8	540	2.9	554
7/13	51.7	16	73	14,793	2.7	544	2.9	554

Table 9. Comparison of sockeye salmon spawning escapement estimates based on catchability analysis of test-fishing data and visual counts from observation towers, Ugashik River, 1993.

Test Fishing		Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Cumulative Number of Sockeye Salmon[a]	Date Plus Travel Time[b]	Cumulative Number of Sockeye Salmon	
6/24	271	6/26	[c]	
6/25	534	6/27	[c]	
6/26	858	6/28	12	7,050
6/27	1,177	6/29	264	346
6/28	1,441	6/30	372	287
6/29	1,729	7/01	402	330
6/30	2,643	7/02	762	247
7/01	3,380	7/03	1,338	153
7/02	4,355	7/04	2,328	87
7/03	7,034	7/05	3,564	97
7/04	8,653	7/06	5,340	62
7/05	11,966	7/07	11,178	7
7/06	63,352	7/08	148,932	-57
7/07	224,845	7/09	555,084	-59
7/08	380,416	7/10	966,150	-61
7/09	440,681	7/11	1,201,350	-63
7/10	455,042	7/12	1,268,322	-64
7/11	461,136	7/13	1,279,320	-64
7/12	463,047	7/14	1,287,270	-64
7/13	466,103	7/15	1,292,046	-64
6/24-7/13			Mean Percent Error (MPE)	454
			Mean Absolute Percent Error (MAPE)	509
7/02-7/13			Mean Percent Error (MPE)	- 20
			Mean Absolute Percent Error (MAPE)	62

[a] Catchability model was: $EPI_m = (2.095 \times 10^{26})\ M_i^{-9.047}$ where M_i = weighted mean length (Stratton and Crawford 1994).

[b] Best travel-time estimate at end of season was 2 d.

[c] Observation towers not in operation.

Table 10. Comparison of sockeye salmon spawning escapement estimates based on mean EPI value (1985–1992: EPI=49) for test-fishing data and visual counts from observation towers, Ugashik River, 1993.

Test Fishing		Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Cumulative Number of Sockeye Salmon	Date Plus Travel Time[a]	Cumulative Number of Sockeye Salmon	
6/24	198	6/26	[b]	
6/25	629	6/27	[b]	
6/26	848	6/38	12	6,967
6/27	1,183	6/29	264	348
6/28	1,631	6/30	372	338
6/29	2,575	7/01	402	541
6/30	4,105	7/02	762	439
7/01	5,207	7/03	1,338	289
7/02	6,481	7/04	2,328	178
7/03	9,812	7/05	3,564	175
7/04	11,706	7/06	5,340	119
7/05	16,424	7/07	11,178	47
7/06	92,913	7/08	148,932	−38
7/07	380,878	7/09	555,084	−31
7/08	595,312	7/10	966,150	−38
7/09	690,205	7/11	1,201,350	−43
7/10	710,179	7/12	1,268,322	−44
7/11	718,828	7/13	1,279,320	−44
7/12	721,259	7/14	1,287,270	−44
7/13	724,874	7/15	1,292,046	−44
6/24–7/13			Mean Percent Error (MPE)	506
			Mean Absolute Percent Error (MAPE)	543
7/02–7/13			Mean Percent Error (MPE)	16
			Mean Absolute Percent Error (MAPE)	70

[a] Best travel-time estimate at end of season was 2 d.

[b] Observation towers not in operation.

Table 11. Comparison of sockeye salmon spawning escapement estimates based on travel-time analysis of test-fishing data and visual counts from observation towers, Ugashik River, 1993.

Test Fishing				Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Travel Time (d)	EPI Value	Cumulative Number of Sockeye Salmon	Date Plus Travel Time	Cumulative Number of Sockeye Salmon	
7/02	2	9	1,203	7/04	2,328	-48
7/03	3	15	3,198	7/06	5,340	-40
7/04	1	11	2,777	7/05	3,564	-22
7/05	2	17	5,965	7/07	11,178	-47
7/06	1	15	30,208	7/07	11,178	170
7/07	1	5	45,821	7/08	148,932	-69
7/08	1	19	232,780	7/09	555,084	-58
7/09	2	71	1,005,890	7/11	1,201,350	-16
7/10	2	79	1,152,571	7/12	1,268,322	- 9
7/11	2	85	1,251,170	7/13	1,279,320	- 2
7/12	2	87	1,288,108	7/14	1,287,270	0
7/13	2	87	1,290,080	7/15	1,292,046	0
7/02-7/13					Mean Percent Error (MPE)	12
					Mean Absolute Percent Error (MAPE)	40

Table 12. Sockeye salmon spawning escapement test-fishing data summary, Igushik River, 1993.

Date	Fishing Time (min)	Catch (No)	Index	Cumulative Index	Daily Mean Weight (kg)	Daily Mean Length (mm)	Weighted Season Mean Weight (kg)	Weighted Season Mean Length (mm)
6/18	60.8	0	0	0				
6/19	126.4	7	14	14	4.4	564	4.4	564
6/20	124.8	17	32	46	4.2	566	4.3	565
6/21	122.9	11	20	66	3.1	555	3.8	561
6/22	126.1	0	0	66				
6/23	122.6	6	11	77	3.4	555	3.9	561
6/24	72.6	2	6	83	3.4	574	3.9	561
6/25	125.4	0	0	83				
6/26	61.7	4	15	98	2.9	584	3.8	563
6/27	126.4	27	49	147	3.4	557	3.6	561
6/28	104.8	31	160	307	3.2	555	3.4	557
6/29	63.3	3	11	318	3.1	547	3.4	557
6/30	124.1	1	2	320	3.4	582	3.4	557
7/01	74.5	5	18	338	5.0	538	3.5	557
7/02	62.8	18	68	406	3.1	541	3.4	555
7/03	128.5	11	20	426	3.5	563	3.4	555
7/04	131.1	7	13	439	3.4	568	3.4	556
7/05	129.6	3	6	445	3.1	573	3.4	556
7/06	122.4	0	0	445				
7/07	123.7	1	2	447	2.4	372	3.4	555
7/08	126.8	2	4	451	2.9	535	3.4	555
7/09	124.3	1	2	453	3.2	560	3.4	555
7/10	125.8	11	21	474	2.5	520	3.4	553
7/11	125.5	19	37	511	2.8	510	3.3	550

Table 13. Comparison of sockeye salmon spawning escapement estimates based on mean EPI value (1988–89 and 1991–92: EPI=51) for test-fishing data and visual counts from observation towers, Igushik River, 1993.

Test Fishing		Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Cumulative Number of Sockeye Salmon	Date Plus Travel Time[a]	Cumulative Number of Sockeye Salmon	
6/18	0	6/24	6,420	
6/19	689	6/25	11,628	– 94
6/20	2,321	6/26	15,618	– 85
6/21	3,362	6/27	24,462	– 86
6/22	3,362	6/28	38,310	– 91
6/23	3,947	6/29	60,876	– 94
6/24	4,253	6/30	85,020	– 95
6/25	4,253	7/01	109,380	– 96
6/26	5,039	7/02	119,100	– 96
6/27	7,515	7/03	141,828	– 95
6/28	15,656	7/04	162,564	– 90
6/29	16,229	7/05	195,042	– 92
6/30	16,322	7/06	244,230	– 93
7/01	17,221	7/07	280,992	– 94
7/02	20,668	7/08	300,618	– 93
7/03	21,666	7/09	312,174	– 93
7/04	22,324	7/10	318,846	– 93
7/05	22,612	7/11	323,394	– 93
7/06	22,612	7/12	330,360	– 93
7/07	22,708	7/13	344,952	– 93
7/08	22,906	7/14	359,586	– 94
7/09	23,002	7/15	373,056	– 94
7/10	24,062	7/16	382,026	– 94
7/11	25,922	7/17	388,512	– 93
6/18–7/11			Mean Percent Error (MPE)	– 93
			Mean Absolute Percent Error (MAPE)	93
6/26–7/11			Mean Percent Error (MPE)	– 93
			Mean Absolute Percent Error (MAPE)	93

[a] Best travel-time estimate at end of season was 6 d.

Table 14. Comparison of sockeye salmon spawning escapement estimates based on travel-time analysis of test-fishing data and visual counts from observation towers, Igushik River, 1993.

Test Fishing				Observation Towers		Percent Error (PE) of Test Fishing Estimate
Date	Travel Time (days)	EPI Value	Cumulative Number of Sockeye Salmon	Date Plus Travel Time	Cumulative Number of Sockeye Salmon	
6/26	5	236	23,407	7/01	109,380	- 79
6/27	3	293	43,214	6/30	85,020	- 49
6/28	3	459	140,989	7/01	109,380	29
6/29	3	604	192,348	7/02	119,100	62
6/30	3	569	182,143	7/03	141,828	28
7/01	3	352	119,052	7/04	162,564	- 27
7/02	3	370	150,208	7/05	195,042	- 23
7/03	3	439	186,737	7/06	244,230	- 24
7/04	2	398	174,343	7/06	244,230	- 29
7/05	3	478	212,125	7/08	300,618	- 29
7/06	4	599	265,939	7/10	318,846	- 17
7/07	5	690	307,461	7/12	330,360	- 7
7/08	6	738	331,884	7/14	359,586	- 8
7/09	6	732	330,213	7/15	373,056	- 11
7/10	6	728	343,519	7/16	382,026	- 10
7/11	6	729	370,712	7/17	388,512	- 5
6/26-7/11					Mean Percent Error (MPE)	- 12
					Mean Absolute Percent Error (MAPE)	27

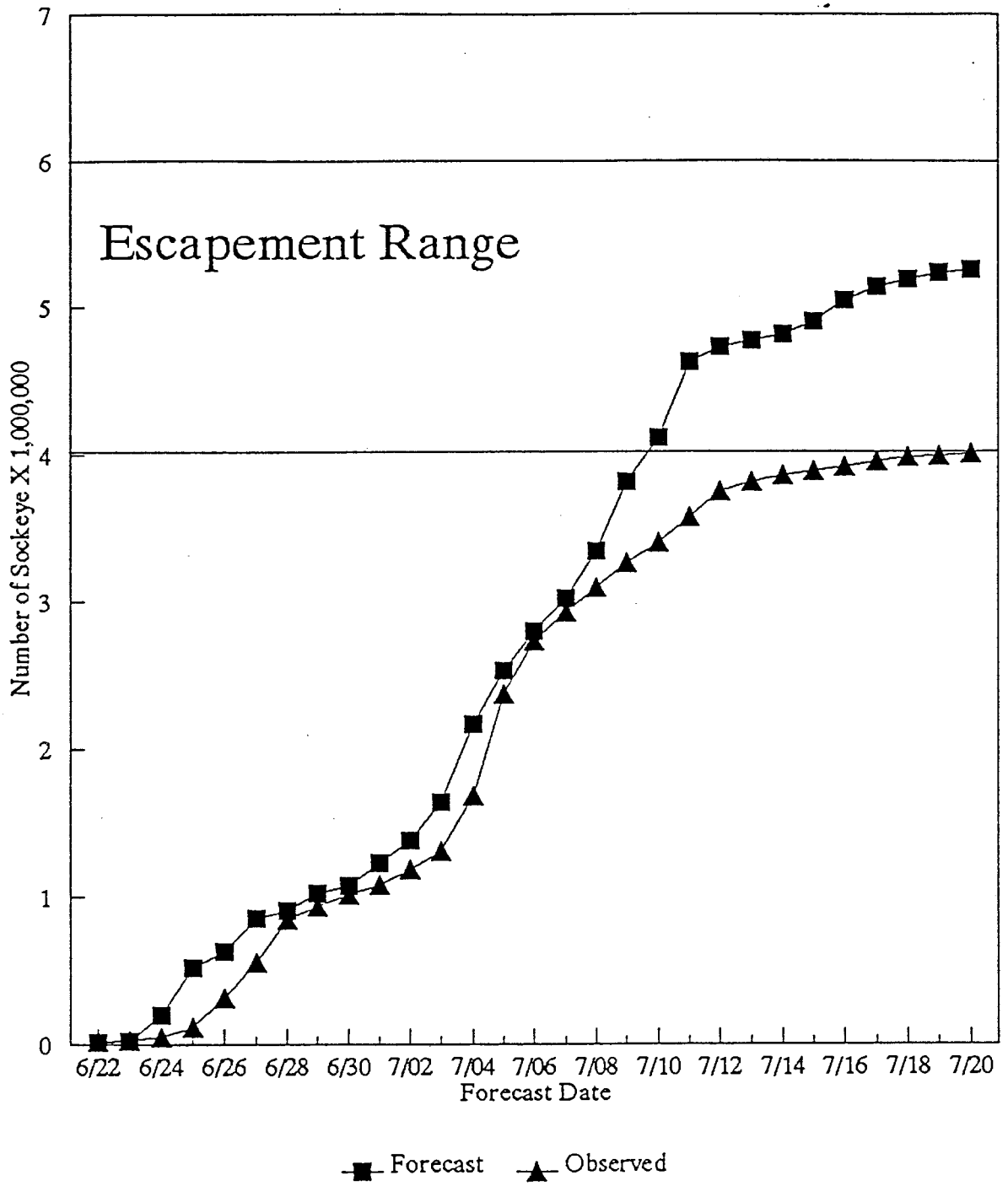

Figure 1. Comparison of 1985-1992 mean EPI value sockeye salmon escapement forecast and observed escapement, Kvichak River, 1993.

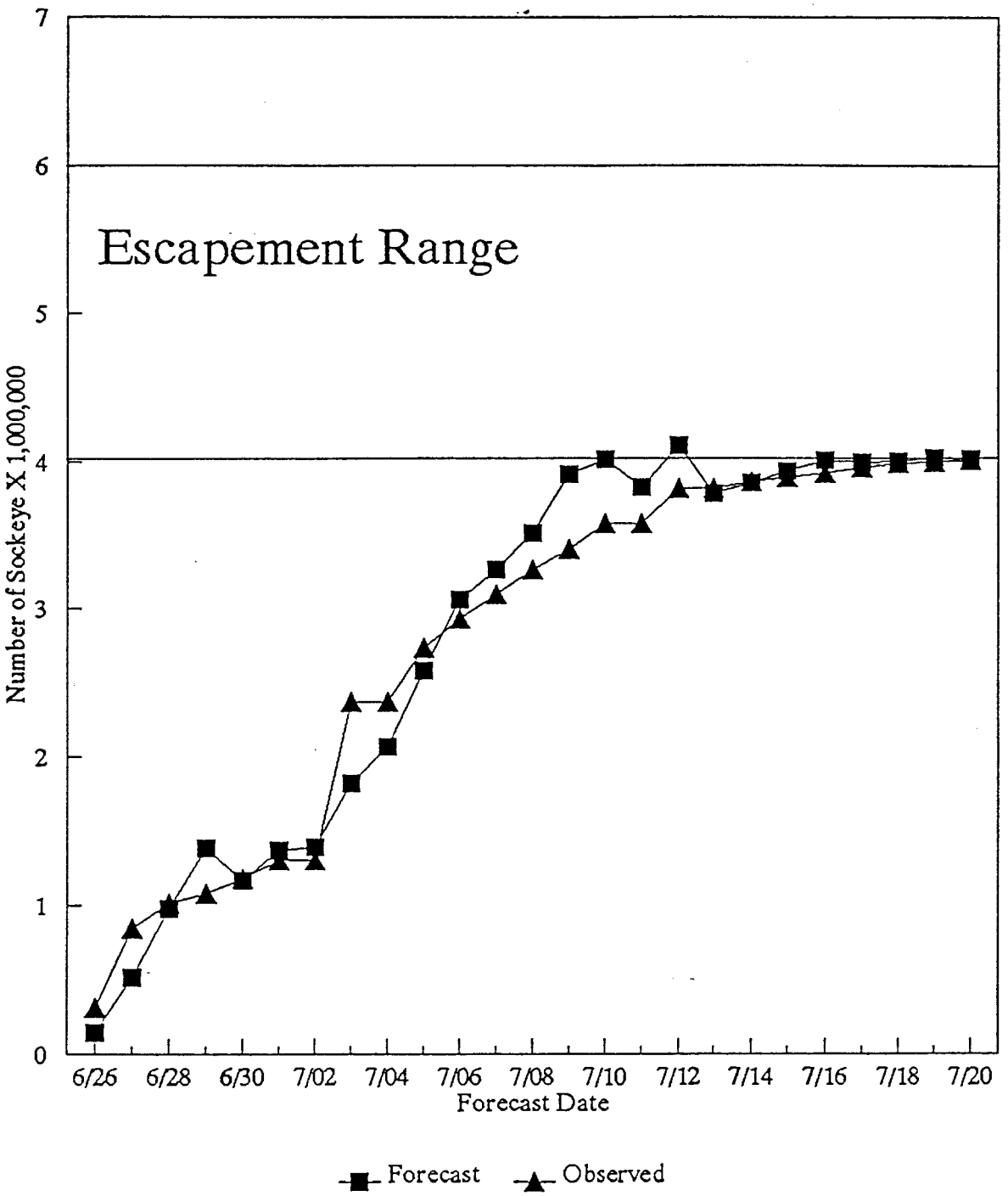

Figure 2. Comparison of travel-time analysis sockeye salmon escapement forecast and observed escapement, Kvichak River, 1993.

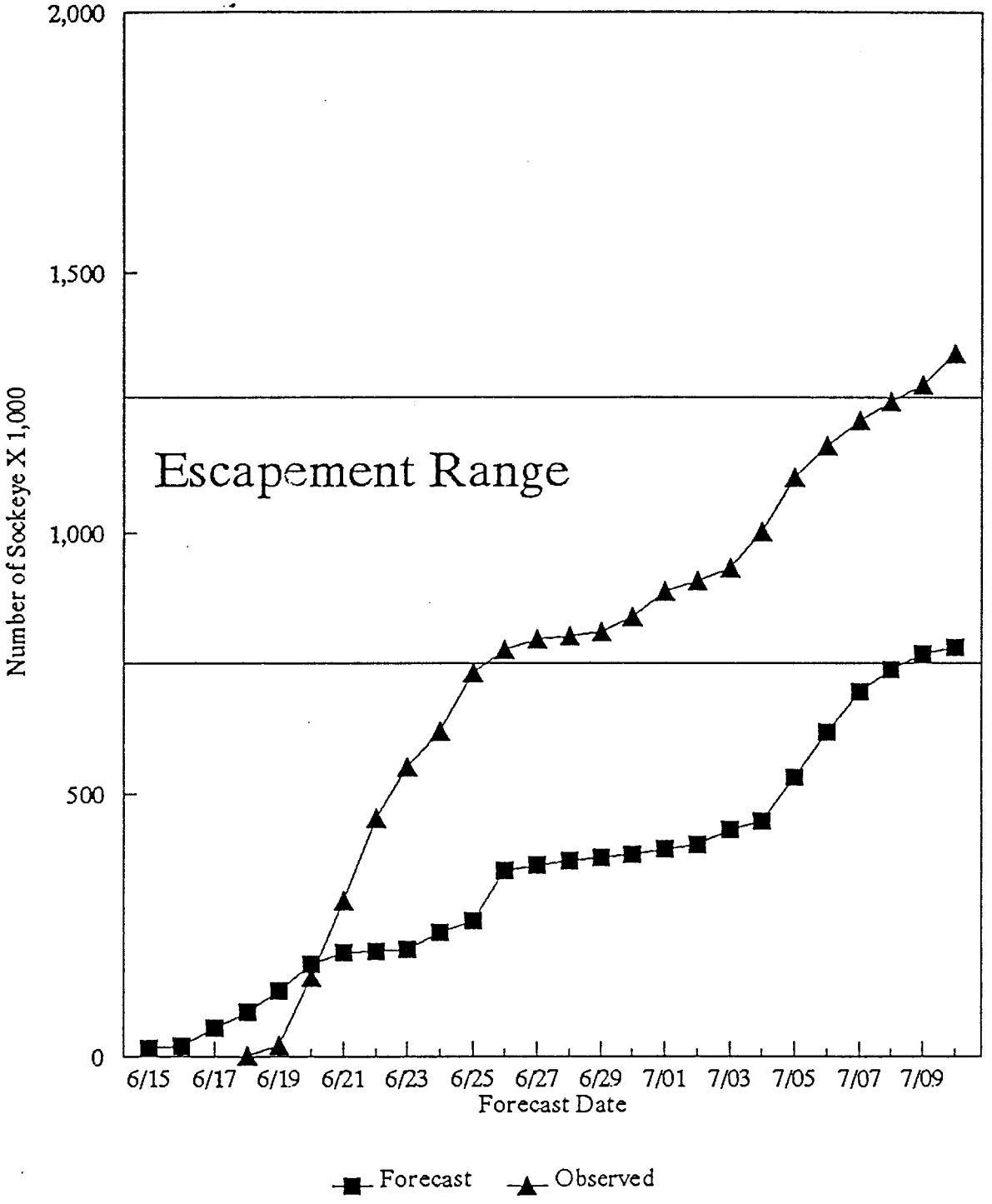

Figure 3. Comparison of catchability analysis sockeye salmon escapement forecast and observed escapement, Egegik River, 1993.

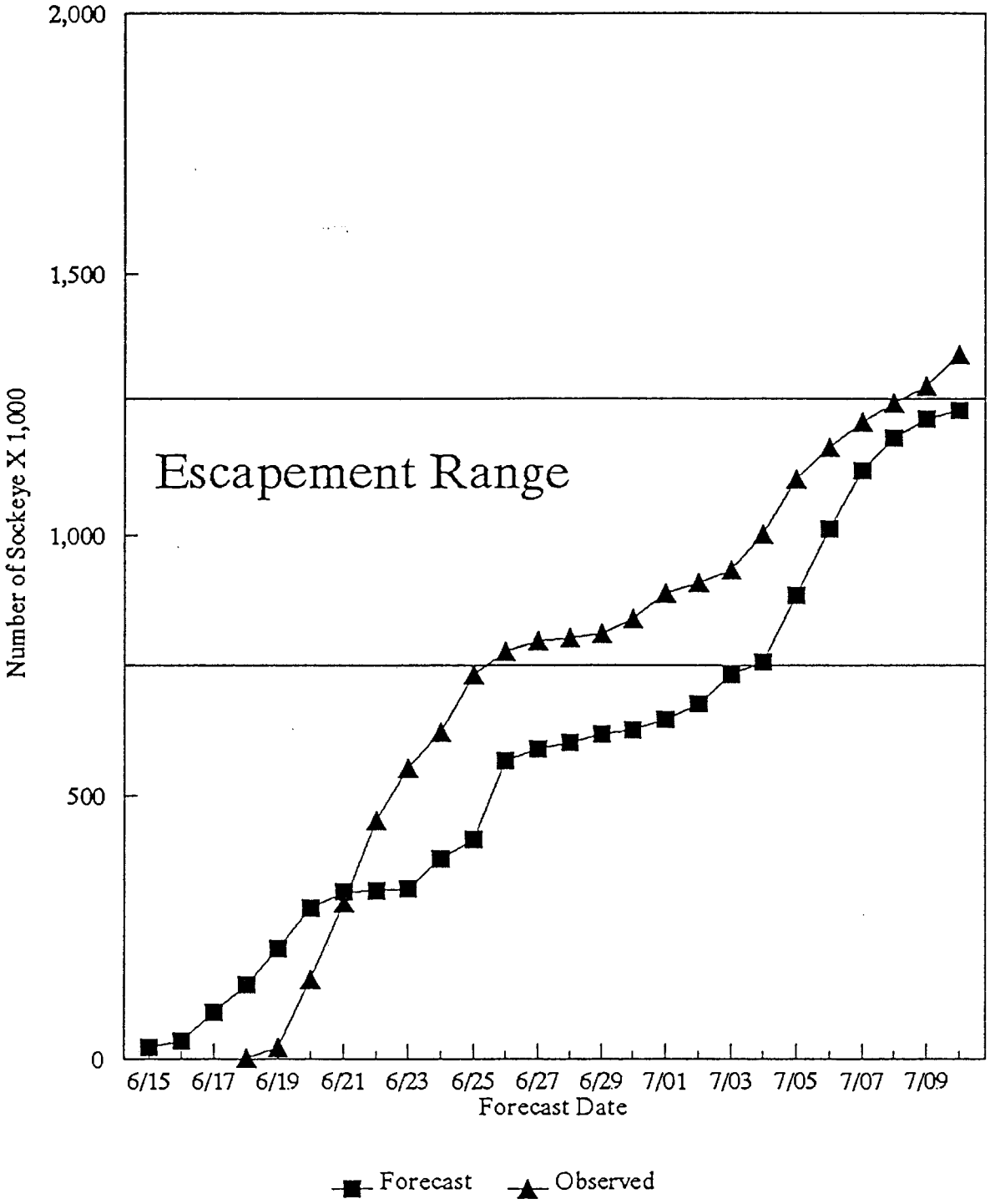

Figure 4. Comparison of 1985-1992 mean EPI value sockeye salmon escapement forecast and observed escapement, Egegik River, 1993.

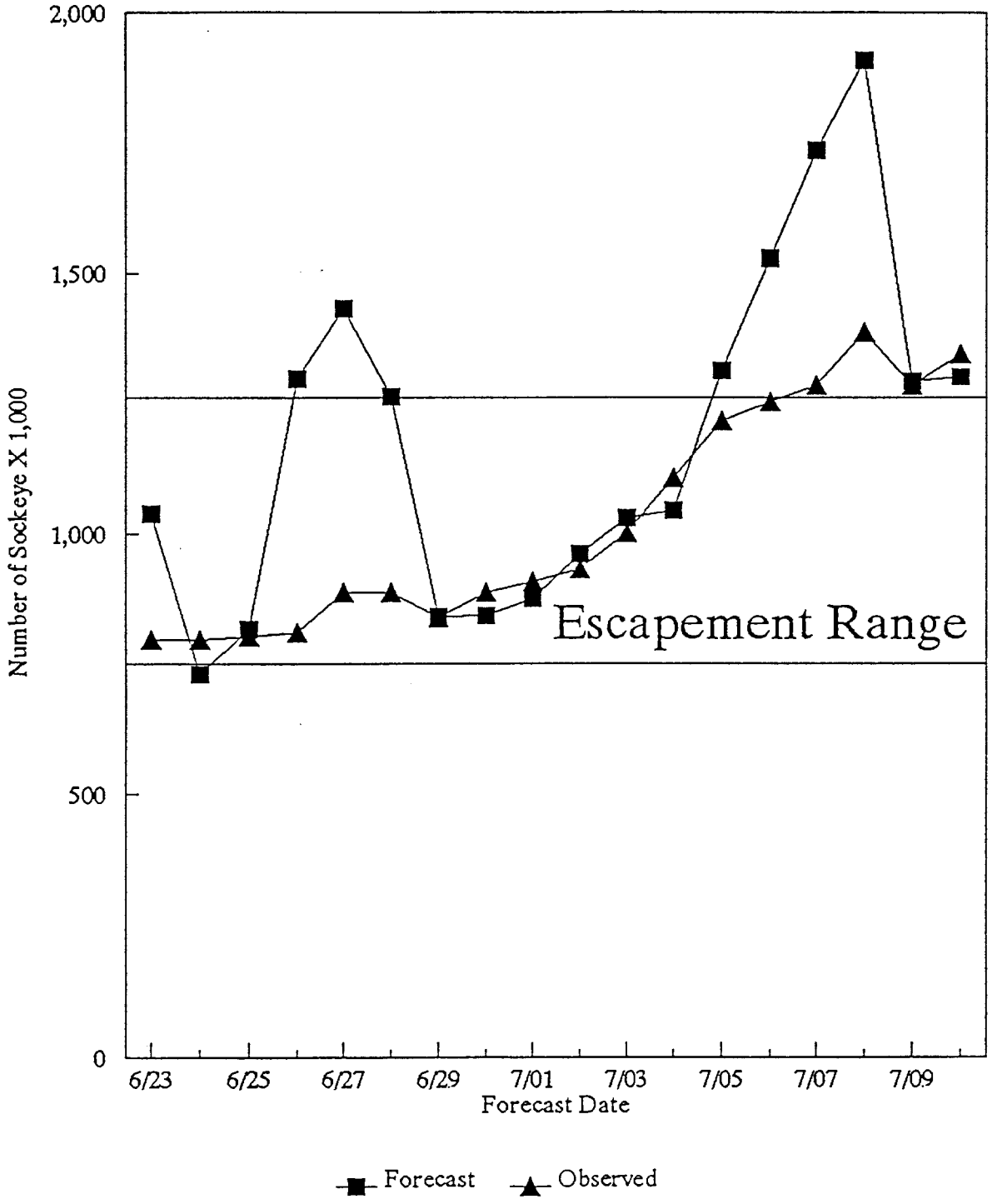

Figure 5. Comparison of travel-time analysis sockeye salmon escapement forecast and observed escapement, Egegik River, 1993.

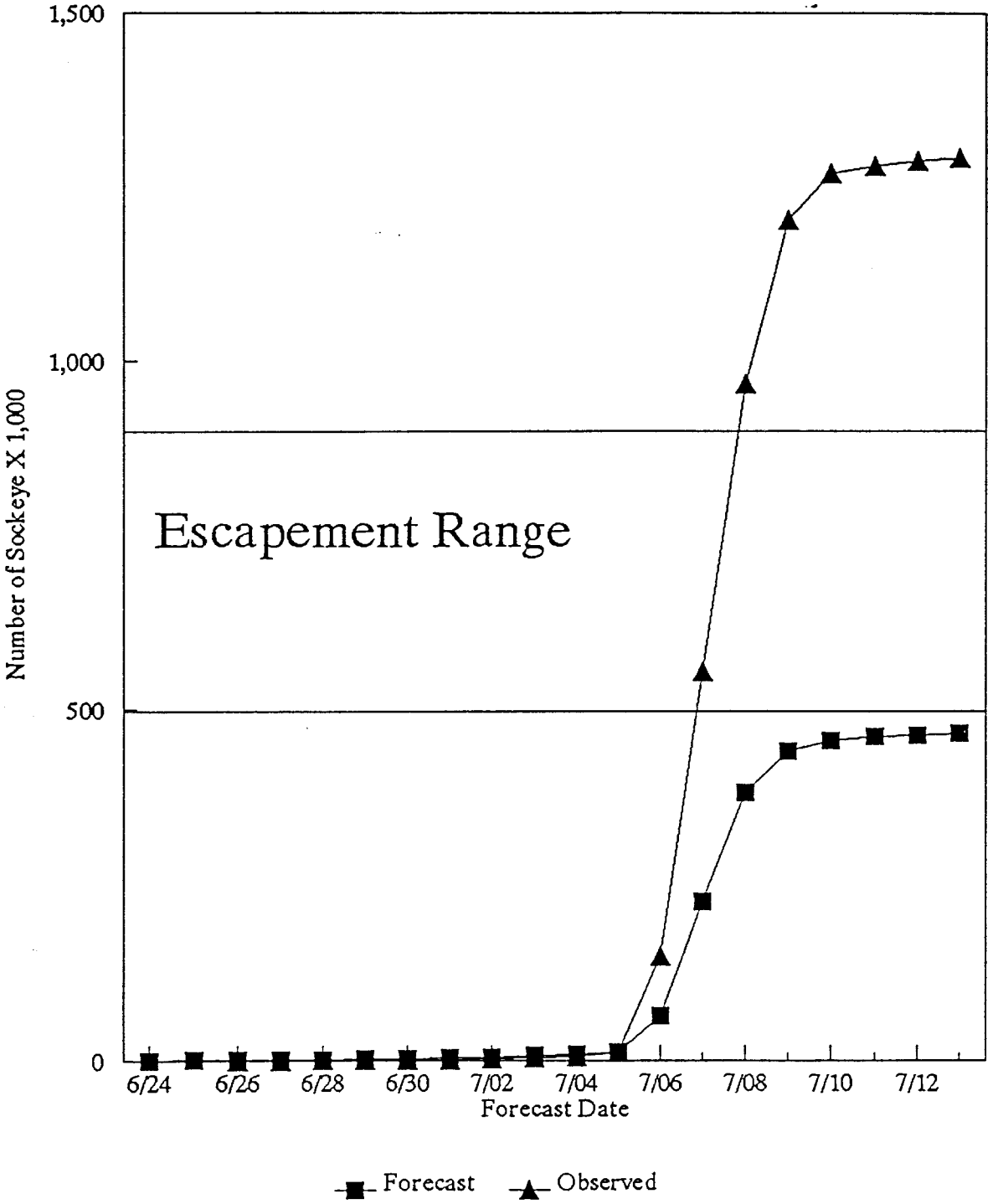

Figure 6. Comparison of catchability analysis sockeye salmon escapement forecast and observed escapement, Ugashik River, 1993.

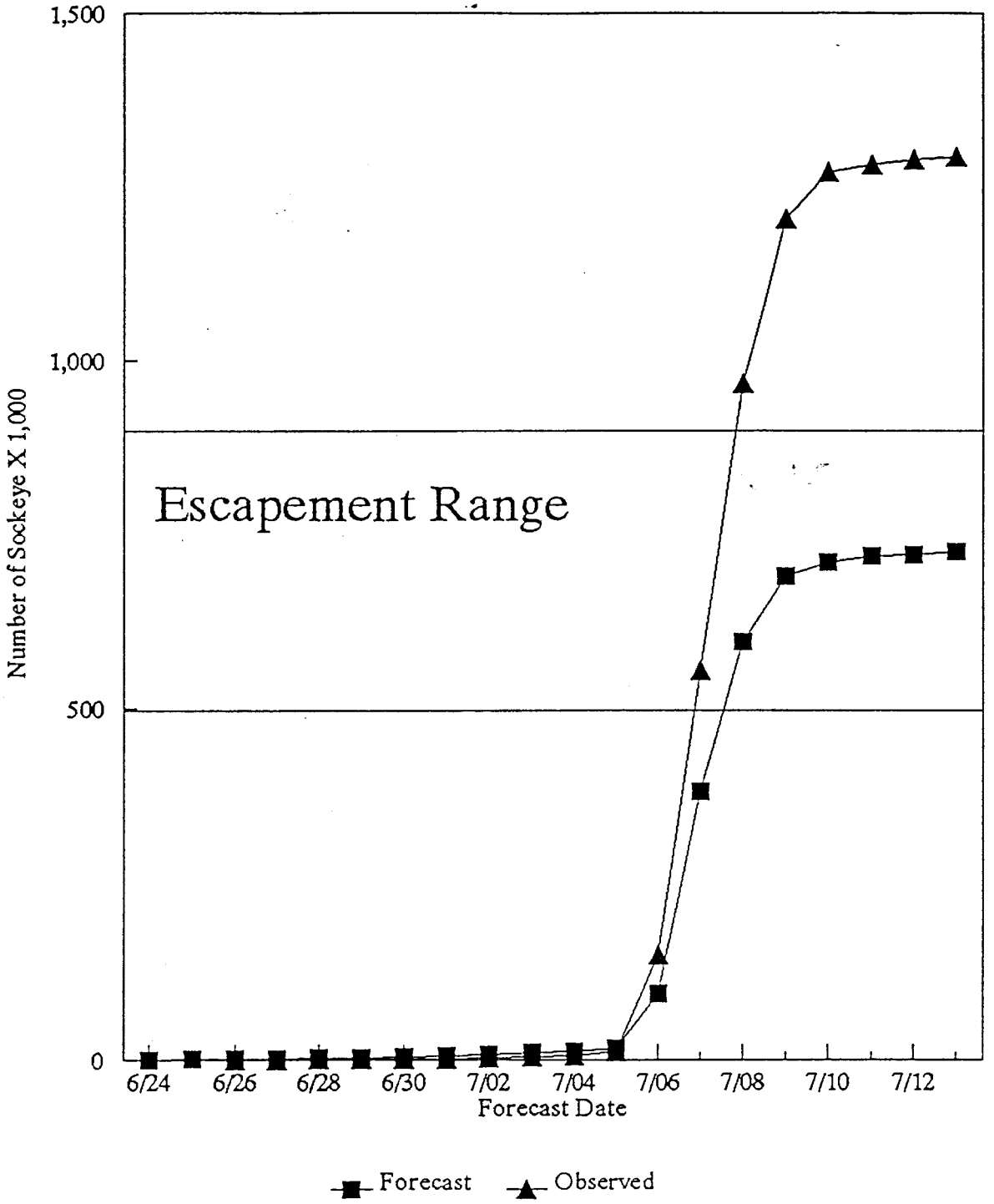

Figure 7. Comparison of 1985-1992 mean EPI value sockeye salmon escapement forecast and observed escapement, Ugashik River, 1993.

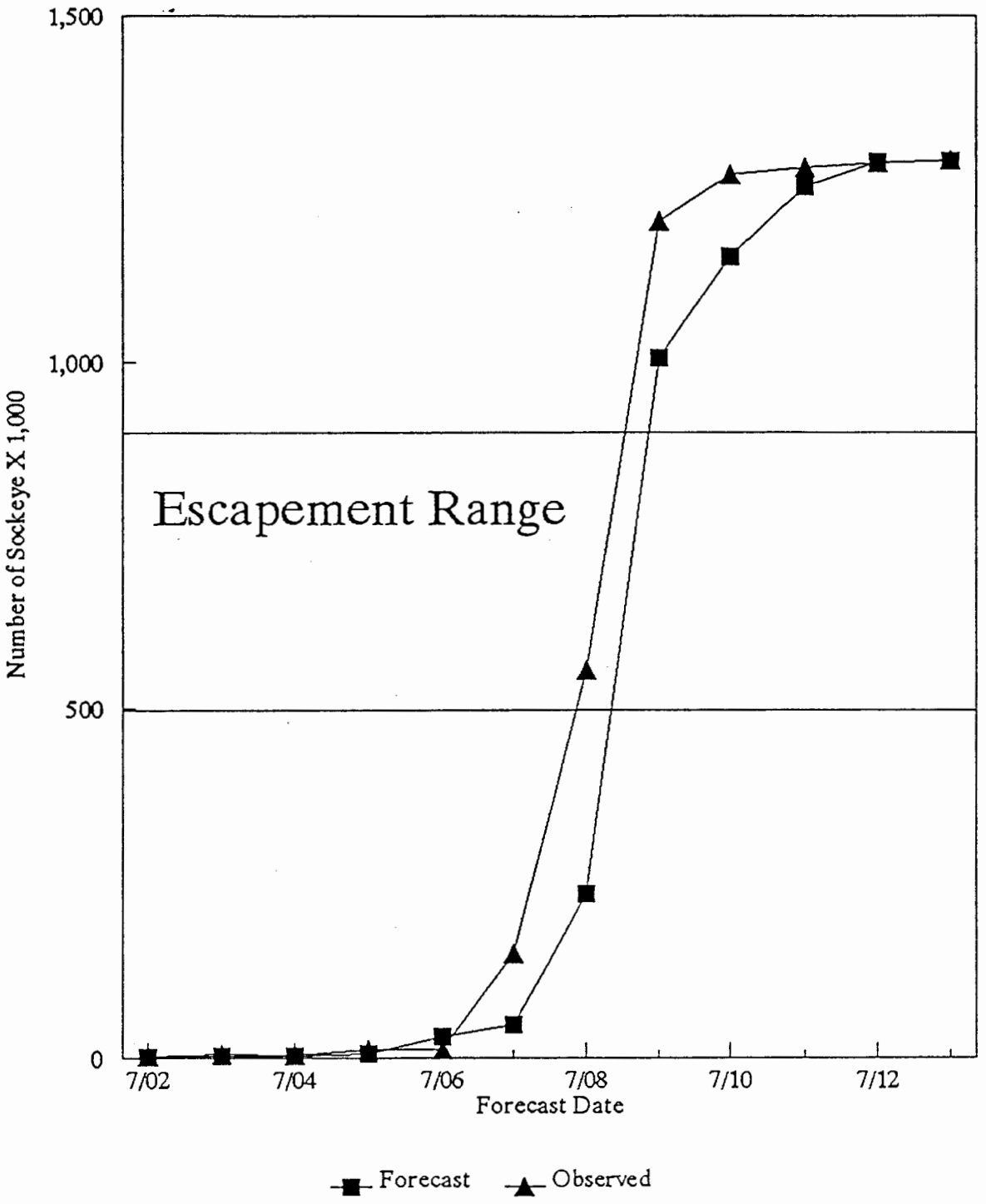

Figure 8. Comparison of travel-time analysis sockeye salmon escapement forecast and observed escapement, Ugashik River, 1993.

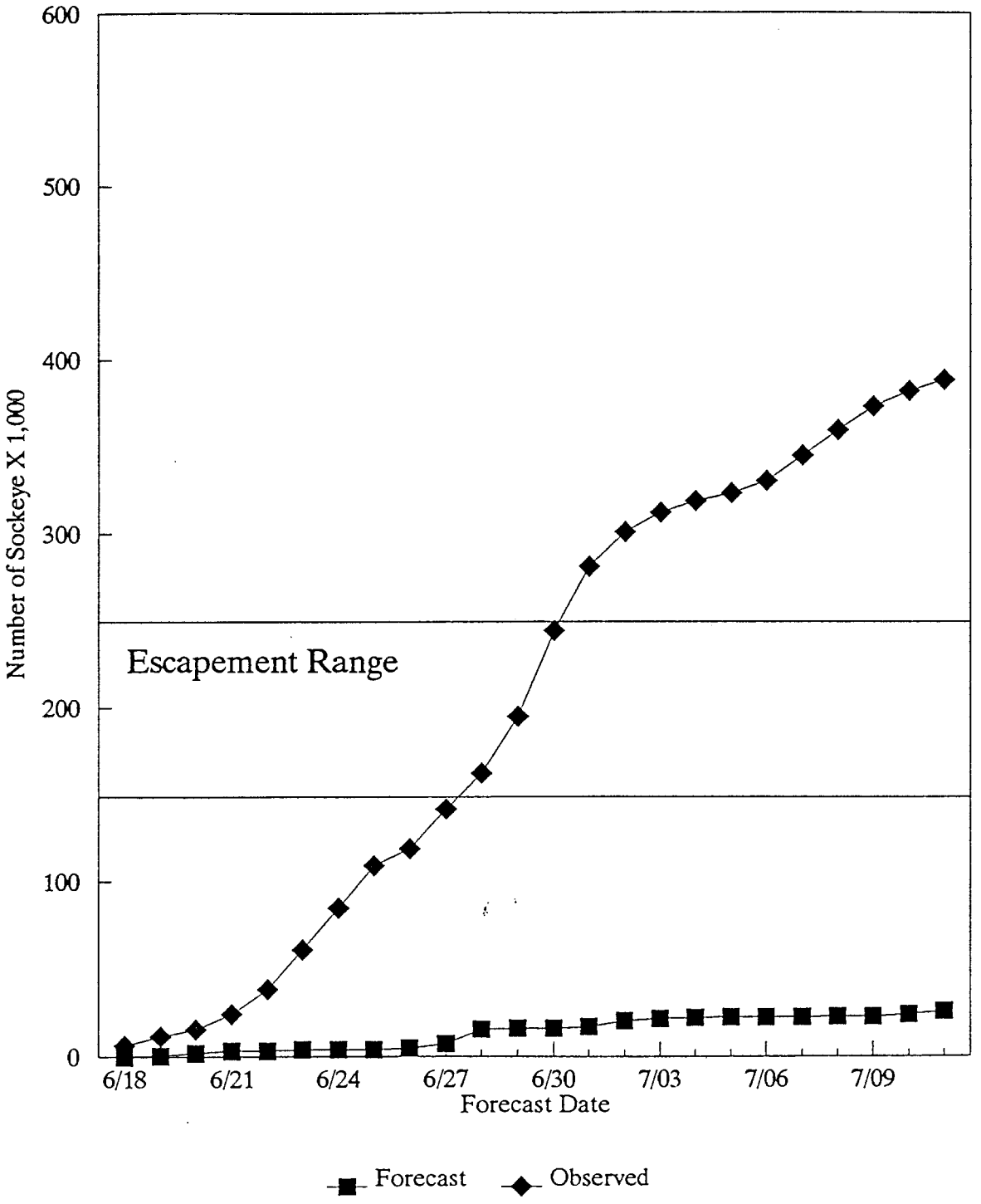

Figure 9. Comparison of 1988-1989 and 1991-1992 mean EPI value sockeye salmon escapement forecast and observed escapement, Igushik River, 1993.

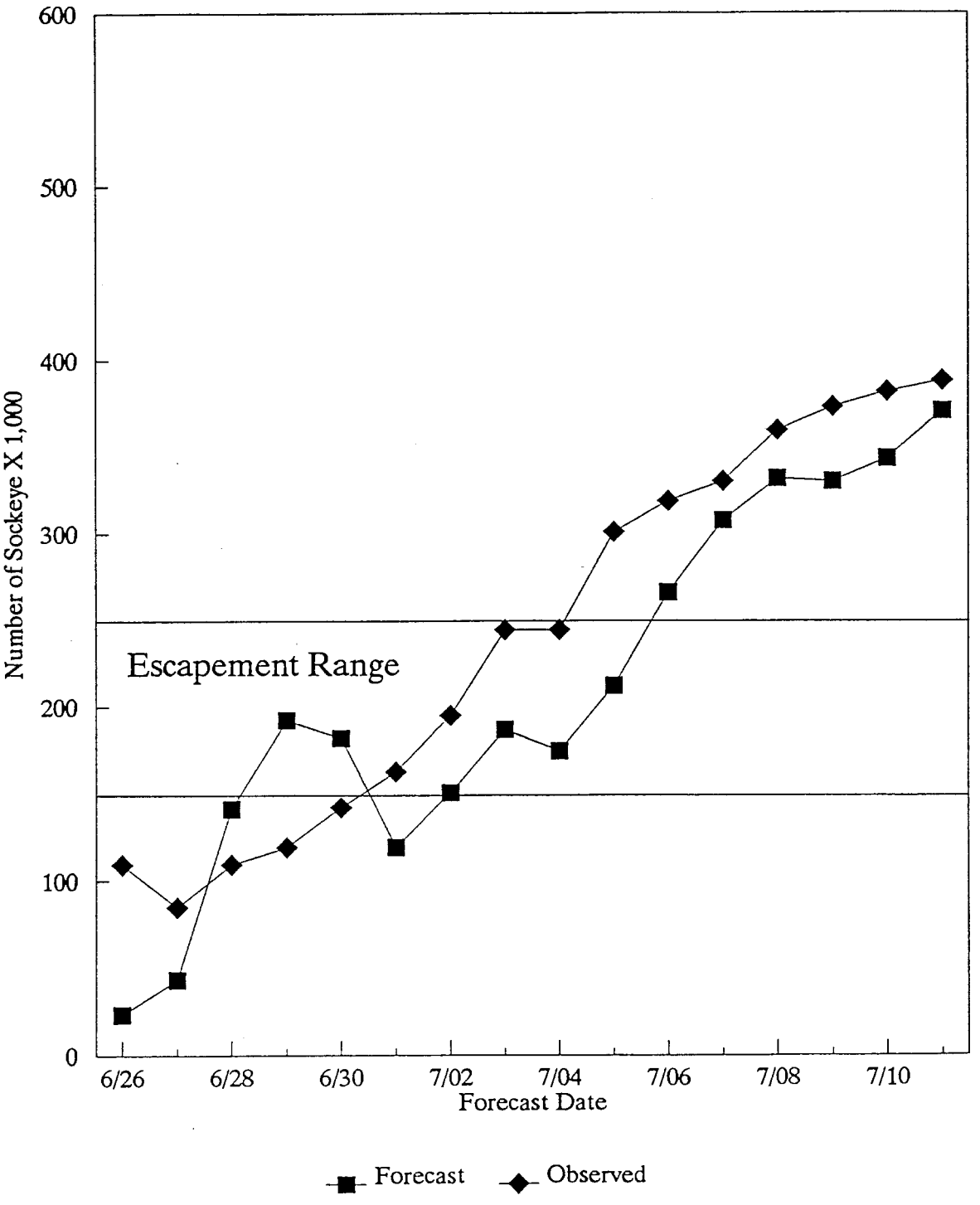

Figure 10. Comparison of travel time analysis sockeye salmon escapement forecast and observed escapement, Igushik River, 1993.

A.1. Sockeye salmon test-fishing data, Kvichak River, 1993.

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/22	1	1	10.0	0	0.0		
6/22	2	2	10.9	0	0.0		
6/22	3	1	12.8	0	0.0		
6/22	4	2	8.5	23	649.4	2.6	563
6/23	5	1	9.0	2	53.3	3.2	582
6/23	6	2	9.5	1	25.3	2.2	538
6/23	7	1	6.9	1	34.8	3.5	620
6/23	8	2	6.8	5	176.5	2.6	545
6/24	9	1	7.9	0	0.0		
6/24	10	2	11.5	2	41.7	2.5	538
6/24	11	1	9.3	8	206.5	3.4	545
6/24	12	2	2.6	65	6,000.0	2.6	547
6/25	13	1	7.5	4	128.0	3.3	578
6/25	14	2	2.4	10	1,000.0	3.0	551
6/25	15	1	10.4	3	69.2	4.5	542
6/25	16	2	1.5	64	10,240.0	2.7	533
6/25[a]	17	1	9.3	2	51.6		
6/26	18	1	8.4	19	542.9	2.5	547
6/26	19	2	9.6	10	250.0	3.0	568
6/26[b]	20	1	3.4	30	2,117.6	2.6	544
6/27	21	1	3.1	36	2,787.1	2.7	544
6/27	22	2	2.0	27	3,240.0	3.3	555
6/27	23	1	8.3	50	1,445.8	2.9	547
6/27	24	2	3.3	10	727.3	3.9	557
6/28	25	1	8.4	16	457.1	3.8	564
6/28	26	2	2.6	12	1,107.7	2.9	527
6/28	27	1	10.0	13	312.0	2.3	529
6/28	28	2	10.3	3	69.9	4.1	552
6/29	29	1	5.4	40	1,777.8	3.4	550
6/29	30	2	7.8	9	276.9	2.4	548
6/30	31	1	9.8	9	220.4	4.2	544
6/30	32	2	6.9	8	278.3	3.5	538
6/30	33	1	9.1	9	237.4	2.8	539
6/30	34	2	9.4	38	970.2	3.0	549
7/01	35	1	10.8	2	44.4	4.2	576
7/01	36	2	10.0	17	408.0	2.9	543
7/01	37	1	4.0	23	1,380.0	3.2	547
7/01	38	2	3.0	47	3,760.0	3.1	539
7/02	39	1	8.8	10	272.7	2.3	535
7/02	40	2	8.3	1	28.9	3.6	573

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A.1. (p 2 of 3).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
7/02	41	1	5.8	109	4,510.3		
7/02	42	2	8.5	23	649.4	2.9	548
7/03	43	1	3.3	34	2,472.7	3.7	542
7/03	44	2	7.0	26	891.4	3.1	542
7/03	45	1	2.8	49	4,200.0	3.6	530
7/03	46	2	2.1	18	2,057.1	2.5	539
7/04	47	1	2.5	45	4,320.0	3.4	540
7/04	48	2	2.3	31	3,234.8	3.1	531
7/04	49	1	1.8	34	4,533.3	2.9	525
7/04	50	2	1.8	52	6,933.3	2.9	520
7/05	51	1	7.1	10	338.0	3.0	537
7/05	52	2	2.5	39	3,744.0	2.9	536
7/05	53	1	6.6	9	327.3	3.5	514
7/05	54	2	2.8	100	8,571.4	3.2	530
7/06	55	1	7.8	13	400.0	3.5	521
7/06	56	2	6.3	42	1,600.0	2.7	524
7/06	57	1	5.1	24	1,129.4	4.2	537
7/06	58	2	2.4	65	6,500.0	3.0	537
7/07	59	1	6.9	19	660.9	2.7	536
7/07	60	2	5.0	30	1,440.0	3.3	529
7/07	61	1	4.1	33	1,931.7	2.3	541
7/07	62	2	2.8	49	4,200.0	3.1	552
7/08	63	1	5.5	11	480.0	3.7	551
7/08	64	2	3.6	19	1,266.7	3.1	533
7/08	65	1	8.3	27	780.7	2.9	518
7/08	66	2	2.4	91	9,100.0	3.0	535
7/09	67	1	6.9	17	591.3	3.2	521
7/09	68	2	4.0	38	2,280.0	2.6	532
7/09	69	1	3.8	25	1,578.9	3.3	541
7/09	70	2	1.5	78	12,480.0	3.1	541
7/10	71	1	6.8	12	423.5		
7/10	72	2	5.1	26	1,223.5	2.9	543
7/10	73	1	6.5	25	923.1	2.7	535
7/10	74	2	2.0	69	8,280.0	2.8	547
7/11	75	1	5.0	23	1,104.0		
7/11	76	2	1.5	53	8,480.0		
7/11	77	1	3.3	15	1,090.9	2.5	544
7/11	78	2	1.8	59	7,866.7	2.8	518

-Continued-

A.1. (p 3 of 3).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
7/12	79	1	9.3	1	25.8	3.5	583
7/12	80	2	3.6	39	2,600.0	2.7	538
7/12	81	1	8.8	5	136.4	2.9	551
7/12	82	2	5.3	19	860.4	2.2	517
7/13	83	1	10.5	3	68.6	2.0	528
7/13	84	2	5.8	17	703.4	2.9	534
7/14	85	1	9.0	5	133.3	2.3	536
7/14	86	2	9.0	25	666.7	2.4	513
7/14	87	1	8.8	2	54.5	2.3	542
7/14	88	2	8.5	27	762.4	2.4	533
7/15	89	1	9.1	2	52.7	1.9	531
7/15	90	2	9.0	25	666.7	2.6	536
7/15	91	1	8.3	24	694.0	2.2	530
7/15	92	2	5.4	41	1,822.2	2.7	533
7/16	93	1	10.0	8	192.0	2.5	548
7/16	94	2	9.1	15	395.6	2.6	549
7/16	95	1	6.5	18	664.6	3.0	550
7/16	96	2	2.4	38	3,800.0	2.8	540
7/17	97	1	5.8	5	206.9	3.2	580
7/17	98	2	5.8	10	413.8	2.8	563
7/17	99	1	4.5	14	746.7	2.4	565
7/17	100	2	1.9	16	2,021.1	2.3	528
7/18	101	1	6.3	1	38.1	2.8	552
7/18	102	2	7.3	3	98.6	2.2	563
7/18	103	1	3.5	10	685.7	2.6	541
7/18	104	2	4.3	19	1,060.5	2.2	536
7/19	105	1	9.4	2	51.1	2.1	575
7/19	106	2	7.1	8	270.4	2.2	535
7/19	107	1	8.5	5	141.2	2.6	526
7/19	108	2	4.1	21	1,229.3	2.3	539
7/20	109	1	9.3	1	25.8	3.1	576
7/20	110	2	8.5	2	56.5	1.7	490
7/20	111	1	4.9	3	146.9	3.0	558
7/20	112	2	5.4	13	577.8	2.4	537

[a] Test drift 500 yards downstream of Station #1. Data not used in analysis.

[b] High winds prevented crew from completing pm drift at Station #2.

A.2. Age, sex, and size composition of sockeye salmon caught in the Kvichak River test fishery, 1993.

	Age Group					
	0.3	1.2	1.3	2.2	2.3	Total
All Periods Combined						
			MALES			
Percent		10.43	9.66	18.09	2.55	40.73
Sample Size		94	87	163	23	367
Mean Length		515	596	543	593	551
Std. Error		3	3	2	6	1
Sample Size		94	87	163	23	367
Mean Weight		2.63	4.04	3.11	3.85	3.25
Std. Error		0.14	0.22	0.12	0.56	0.09
Sample Size		24	14	39	4	81
			FEMALES			
Percent	0.33	15.54	13.43	25.86	4.11	59.27
Sample Size	3	140	121	233	37	534
Mean Length	549	510	574	527	559	535
Std. Error	21	2	3	2	5	1
Sample Size	3	140	121	231	37	532
Mean Weight	4.36	2.29	3.19	2.60	3.03	2.69
Std. Error		0.11	0.13	0.08	0.28	0.06
Sample Size	1	27	25	58	8	119
			ALL FISH			
Percent	0.33	25.97	23.09	43.95	6.66	100.00
Sample Size	3	234	208	396	60	901
Mean Length	549	512	583	533	572	542
Std. Error	21	2	2	1	4	1
Sample Size	3	234	208	394	60	899
Mean Weight	4.36	2.43	3.55	2.81	3.34	2.92
Std. Error		0.09	0.12	0.07	0.27	0.05
Sample Size	1	51	39	97	12	200

A.3. Kvichak River sockeye salmon test-fishing data, 1979-1993.

Year	Weighted Season Mean Weight	Weighted Season Mean Length	Travel Time (d)	Indices Cumulative Number	Indices Last Date Fished	Spawning Escapement Cumulative Number	Spawning Escapement Date[a]	EPI	Test Fishing Data Reference
1979[b]	2.5	520	2	21,901	6/29	5,330,532	7/01	243	Meacham (1980)
1980	2.2	514	2	106,315	7/09	18,508,524	7/11	174	Bue & Meacham (1981)
1981	2.6	529	2	20,813	7/01	1,723,506	7/13	83	Bue (1982)
1982	2.6	532	2	17,718	7/21	1,119,996	7/23	63	Bue (1984)
1983	2.3	514	2	13,234	7/12	2,853,198	7/14	216	Yuen (1985)
1984	2.3	519	3	45,584	7/12	10,111,152	7/15	222	Yuen et al. (1985)
1985[c]	2.5	538	5	41,649	7/16	7,120,506	7/23	171	Bue et al. (1988)
1986	2.5	530	1	25,923	7/15	1,102,242	7/16	43	Yuen et al. (1988)
1987	2.1	509	2	55,881	7/14	5,945,994	7/16	106	Fried & Bue (1988a)
1988	2.7	548	1	38,743	7/17	4,045,500	7/18	104	Fried & Bue (1988b)
1989	2.4	516	2	58,044	7/16	8,163,918	7/18	141	Stratton et al. (1990)
1990	2.3	510	3	44,794	7/15	6,673,872	7/18	149	Stratton (1990)
1991	2.3	529	2	56,669	7/17	4,114,932	7/19	71	Stratton & Woolington (1992)
1992	2.6	523	4	46,755	7/16	4,686,828	7/20	100	Stratton & Crawford (1994)
Mean	2.4	524	2					135	
1993	2.9	537	1	47,449	7/20	4,007,712	7/21	84	Current Report

[a] Cumulative spawning escapement date is last date fished at test fishing site plus travel time to counting tower site.

[b] Two sites used from 1979-1984: station 1 on west bank above Nakeen; station 2 on east bank about 2 km above Sea Gull Flat Island.

[c] Data from 1985 to present may not be comparable with those from 1979-1984. Test fishing sites were relocated in 1985 about 20 km upriver from old sites, and gillnets with smaller stretched mesh size (12.70 cm instead of 13.65 cm) and different web material (multistrand monofilament instead of multifilament nylon) were used.

A.4. Climatological and hydrological observations made at Kvichak River sockeye salmon test-fishing site, 1993.

Date	Cloud Cover[a] a.m.	Cloud Cover[a] p.m.	Wind Velocity (km/hr) a.m.	Wind Velocity (km/hr) p.m.	Air Temp. (°C) a.m.	Air Temp. (°C) p.m.	Water Temp. (°C) a.m.	Water Temp. (°C) p.m.	Precipitation[b]	Water Clarity
6/21	1	2	5-10 S	5-10 S	-	23	-	-	0	dk. brown
6/22	4	3	5-10 S	0- 5 S	10	14	14	16	A	dk. brown
6/23	4	3	calm	0- 5 SE	10	13	14	14	A	dk. brown
6/24	2	1	0- 5 S	0- 5 SE	13	15	13	14	0	dk. brown
6/25	5	4	0- 5 SE	5-10 SE	8	14	14	14	0	dk. brown
6/26	4	4	0-10 SW	20-30 S	12	12	15	14	A	dk. brown
6/27	3	4	10-15 SE	15-20 SE	10	11	13	14	0	dk. brown
6/28	4	4	calm	5-10 SE	10	12	14	13	A	dk. brown
6/29	4	4	0- 5 SE	calm	9	12	14	14	A	dk. brown
6/30	4	3	0- 5 S	0- 5 SE	11	12	13	13	0	dk. brown
7/01	1	4	calm	20-25 E	10	7	13	14	0	dk. brown
7/02	4	4	0- 5 NE	0-10 E	9	9	14	14	0	dk. brown
7/03	4	4	0- 5 SE	calm	8	9	13	13	A	dk. brown
7/04	4	3	calm	5-10 SW	10	7	12	13	A	dk. brown
7/05	4	4	calm	calm	10	9	13	13	A	dk. brown
7/06	5	4	calm	10-15 SW	8	11	13	14	A	dk. brown
7/07	2	1	calm	0- 5 S	6	14	12	14	0	dk. brown
7/08	2	3	calm	5-10 SW	5	11	12	14	0	dk. brown
7/09	5	1	calm	0- 5 S	9	19	14	14	0	dk. brown
7/10	2	1	calm	0- 5 W	15	18	14	14	0	dk. brown
7/11	1	1	0- 5 S	5-10 S	14	18	14	15	0	dk. brown
7/12	1	4	calm	0- 5 SW	12	20	14	14	0	dk. brown
7/13	4	4	5-10 S	0- 5 S	14	13	14	14	0	dk. brown
7/14	4	3	calm	0- 5 S	11	17	14	14	A	dk. brown
7/15	3	1	0- 5 SW	10-15 SW	15	16	15	16	0	dk. brown
7/16	5	2	calm	5-10 SW	10	17	16	15	0	dk. brown
7/17	5	2	0- 5 S	10-15 SW	11	18	15	15	0	dk. brown
7/18	4	1	calm	0- 5 N	12	18	15	16	0	dk. brown
7/19	5	1	calm	5-10 NE	11	22	15	16	0	dk. brown
7/20	1	1	0- 5 NE	10-15 NE	16	26	15	17	0	dk. brown

[a] 1 = cloud cover not more than 1/10,
2 = cloud cover not more than 1/2,
3 = cloud cover more than 1/2,
4 = completely overcast, and
5 = fog

[b] 0 = none;
A = intermittent rain;
B = continuous rain

APPENDIX B: EGEGIK RIVER

B.1. Sockeye salmon test-fishing data, Egegik River, 1993.

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/15	1	1	5.5	13	567.3	2.6	534
6/15	2	2	4.5	3	160.0	3.4	574
6/15	3	1	5.4	7	311.1	3.0	564
6/15	4	2	4.8	6	300.0	2.0	502
6/15	5	1	4.4	2	109.1	3.0	559
6/15	6	2	5.6	6	228.6	3.2	587
6/15	7	1	6.1	2	78.7	2.2	495
6/15	8	2	4.0	10	600.0	3.1	549
6/16	9	1	6.8	1	35.3	2.2	521
6/16	10	2	6.9	3	104.3	3.0	577
6/16	11	1	5.4	3	133.3	2.2	569
6/16	12	2	5.1	5	235.3	2.8	562
6/16	13	1	6.8	3	105.9	2.3	582
6/16	14	2	7.6	11	347.4	2.6	568
6/16	15	1	5.8	3	124.1	3.1	577
6/16	16	2	7.0	7	240.0	2.4	553
6/17	17	1	5.0	1	48.0	1.9	494
6/17	18	2	6.8	7	247.1	2.8	553
6/17	19	1	6.4	1	37.5	2.1	505
6/17	20	2	6.0	10	400.0	2.6	577
6/17	21	1	3.4	51	3,600.0	3.1	556
6/17	22	2	2.6	14	1,292.3	3.0	552
6/17	23	1	3.8	3	189.5	2.6	539
6/17	24	2	4.9	6	293.9	2.9	546
6/18	25	1	5.6	9	385.7	2.3	517
6/18	26	2	8.0	9	270.0	2.8	567
6/18	27	1	6.6	9	327.3	2.3	542
6/18	28	2	6.3	19	723.8	3.0	564
6/18	29	1	3.8	21	1,326.3	2.6	550
6/18	30	2	6.3	45	1,714.3	2.7	549
6/18	31	1	5.6	5	214.3	3.1	556
6/18	32	2	5.1	20	941.2	3.0	567
6/19	33	1	6.1	5	196.7	2.9	549
6/19	34	2	6.0	21	840.0	3.4	564
6/19	35	1	5.0	6	288.0	3.6	588
6/19	36	2	8.5	52	1,468.2	2.6	549
6/19	37	1	2.5	13	1,248.0	3.0	553
6/19	38	2	5.5	15	654.5	2.8	566

B.1. (p 2 of 4).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/19	39	1	4.6	8	417.4	2.8	550
6/19	40	2	3.3	34	2,472.7	3.2	558
6/20[a]	41	1	4.1	13	761.0	2.8	532
6/20	42	2	4.9	28	1,371.4	3.0	537
6/21	43	1	4.5	0	0.0		
6/21	44	2	5.9	6	244.1	2.6	533
6/21	45	1	7.0	1	34.3	3.1	446
6/21	46	2	4.6	7	365.2	2.8	542
6/21	47	1	3.5	36	2,468.6	2.9	545
6/21	48	2	6.9	5	173.9	3.4	535
6/21	49	1	6.4	1	37.5	3.1	554
6/21	50	2	6.9	0	0.0		
6/22	51	1	5.9	1	40.7	3.0	551
6/22	52	2	6.5	1	36.9	2.4	525
6/22	53	1	6.8	1	35.3	1.8	493
6/22	54	2	7.4	1	32.4	1.9	500
6/23	55	1	7.8	1	30.8	2.0	536
6/23	56	2	4.5	0	0.0		
6/23	57	1	6.9	2	69.6	3.6	600
6/23	58	2	5.4	4	177.8	2.1	515
6/24	59	1	6.0	13	520.0	2.2	554
6/24	60	2	5.1	20	941.2	3.0	555
6/24	61	1	7.3	11	361.6	2.9	533
6/24	62	2	5.8	30	1,241.4	3.7	563
6/25	63	1	6.0	12	480.0	3.7	567
6/25	64	2	4.6	17	887.0	2.9	558
6/25	65	1	8.6	6	167.4	2.7	525
6/25	66	2	6.1	13	511.5	3.1	559
6/26	67	1	8.8	27	736.4	2.9	541
6/26	68	2	4.3	75	4,186.0	3.0	548
6/26	69	1	7.1	3	101.4	3.6	578
6/26	70	2	4.5	62	3,306.7	2.9	555
6/27	71	1	6.8	3	105.9	3.5	585
6/27	72	2	5.4	10	444.4	2.7	567
6/27	73	1	5.3	7	317.0	2.3	527
6/27	74	2	6.1	10	393.4	4.0	598
6/28	75	1	6.3	2	76.2	2.3	526
6/28	76	2	6.8	7	247.1	2.9	575

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B.1. (p 3 of 4).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/28	77	1	5.9	1	40.7	1.6	510
6/28	78	2	6.8	9	317.6	2.5	545
6/29	79	1	7.6	2	63.2	3.5	609
6/29	80	2	7.1	16	540.8	3.3	570
6/29	81	1	7.0	2	68.6	3.3	593
6/29	82	2	7.3	7	230.1	2.5	562
6/30	83	1	6.0	1	40.0	1.8	502
6/30	84	2	7.8	5	153.8	2.8	523
7/01	85	1	7.8	5	153.8	2.6	558
7/01	86	2	7.5	4	128.0	2.9	575
7/01	87	1	6.3	0	0.0		
7/01	88	2	10.1	36	855.4	3.0	572
7/02	89	1	6.4	0	0.0		
7/02	90	2	4.8	17	850.0	2.8	579
7/02	91	1	8.0	7	210.0	3.1	584
7/02	92	2	4.9	13	636.7	3.3	590
7/03	93	1	6.9	4	139.1	2.7	560
7/03	94	2	6.6	20	727.3	2.9	566
7/03	95	1	6.9	5	173.9	2.6	539
7/03	96	2	3.4	30	2,117.6	3.3	571
7/04	97	1	6.1	4	157.4	2.3	530
7/04	98	2	5.1	4	188.2	3.2	588
7/04	99	1	7.0	7	240.0	2.2	525
7/04	100	2	6.0	19	760.0	2.6	538
7/05	101	1	6.9	11	382.6	2.3	530
7/05	102	2	4.0	11	660.0	2.7	545
7/05	103	1	5.1	18	847.1	2.8	529
7/05	104	2	3.3	72	5,236.4	3.0	552
7/06	105	1	3.6	29	1,933.3	2.1	540
7/06	106	2	4.1	17	995.1	2.4	547
7/06	107	1	3.4	29	2,047.1	2.6	539
7/06	108	2	4.0	35	2,100.0	3.3	559
7/07	109	1	3.8	19	1,200.0	2.6	557
7/07	110	2	3.9	8	492.3	2.7	550
7/07	111	1	2.6	24	2,215.4	2.4	542
7/07	112	2	3.5	33	2,262.9	2.4	539
7/08	113	1	6.4	16	600.0	2.1	567
7/08	114	2	4.5	12	640.0	2.4	533

-Continued-

B.1. (p 4 of 4).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
7/08	115	1	6.4	17	637.5	2.8	549
7/08	116	2	4.4	30	1,636.4	2.2	541
7/09	117	1	9.3	13	335.5	2.2	527
7/09	118	2	7.6	5	157.9	3.1	551
7/09	119	1	4.5	20	1,066.7	2.7	531
7/09	120	2	5.3	10	452.8	2.9	535
7/10	121	1	8.4	9	257.1	2.5	518
7/10	122	2	7.3	5	164.4	2.0	497

[a] Four morning drifts and two evening drifts missed due to skiff swamping.

B.2. Age, sex, and size composition of sockeye salmon caught in the Egegik River test fishery, 1993.

	Age Group						
	0.3	1.2	1.3	2.2	1.4	2.3	Total
All Periods Combined							
			MALES				
Percent		0.54	3.36	19.25	0.94	26.25	50.34
Sample Size		4	25	143	7	195	374
Mean Length		498	592	538	602	584	567
Std. Error		26	5	3	12	2	2
Sample Size		4	25	143	7	194	373
Mean Weight		1.53	3.79	2.63	3.98	3.53	3.19
Std. Error		0.23	0.14	0.07	0.16	0.06	0.04
Sample Size		3	11	73	4	89	180
			FEMALES				
Percent	0.13	1.08	1.75	22.61	0.40	23.69	49.66
Sample Size	1	8	13	168	3	176	369
Mean Length	550	500	573	509	592	557	535
Std. Error		6	9	2	22	2	1
Sample Size	1	8	12	168	3	176	368
Mean Weight		1.85	3.09	1.87	3.60	2.74	2.34
Std. Error		0.07	0.19	0.04	0.10	0.07	0.04
Sample Size		4	8	95	2	88	197
			ALL FISH				
Percent	0.13	1.62	5.11	41.86	1.34	49.94	100.00
Sample Size	1	12	38	311	10	371	743
Mean Length	550	499	586	523	599	571	551
Std. Error		10	5	2	11	2	1
Sample Size	1	12	37	311	10	370	741
Mean Weight		1.74	3.55	2.22	3.87	3.16	2.77
Std. Error		0.09	0.11	0.04	0.12	0.05	0.03
Sample Size		7	19	168	6	177	377

B.3. Test-fishing data, 1979-1992, to estimate constants for 1993 Egegik River catchability model.

	Weighted Season Mean			Indices		Spawning Escapement			
Year[a]	Weight	Length	Travel Time (d)	Cumulative Number	Last Date Fished	Cumulative Number	Date[b]	EPI	Test Fishing Data Reference
1979	2.7	548	1	23,980	7/10	905,034	7/11	38	Meacham (1980)
1980	2.3	525	4	13,312	7/16	1,060,860	7/20	80	Bue & Meacham (1981)
1981	2.6	544	3	18,921	7/13	691,764	7/16	37	Bue (1982)
1982	3.0	569	3	30,361	7/12	1,029,684	7/15	34	Bue (1984)
1983	2.6	537	1	16,276	7/10	718,368	7/11	44	Yuen (1985)
1984	2.6	543	3	26,947	7/12	1,151,028	7/15	43	Yuen et al. (1985)
1985[c]	2.4	529	4	19,974	7/09	1,052,250	7/13	53	Bue et al. (1988)
1986	2.5	541	1	16,370	7/14	981,841	7/15	60	Yuen et al. (1988)
1987	2.7	551	2	21,810	7/14	1,162,464	7/16	53	Fried & Bue (1988a)
1988	2.8	553	1	21,024	7/16	1,591,752	7/17	76	Fried & Bue (1988b)
1989	2.7	551	3	30,343	7/12	1,590,234	7/15	52	Stratton et al. (1990)
1990	2.4	525	3	17,578	7/16	2,155,062	7/19	123	Stratton (1990)
1991	2.5	533	4	31,066	7/12	2,722,476	7/16	88	Stratton & Woolington (1992)
1992	2.3	518	3	24,498	7/11	1,795,542	7/14	73	Stratton & Crawford (1994)
Mean	2.6	541	3					60	
1992[d]	2.8	551	1	17,189	7/10	1,346,160	7/11	78	Current Report

[a] Two sites located about 3 km upriver from tip of Egg Island used: station 1 on south bank and station 2 on north bank.

[b] Cumulative spawning escapement date is last date fished at test fishing site plus travel time to counting tower site.

[c] Data from 1985 to present may not be comparable with those from 1979-1984 because gillnets with a smaller stretched mesh size (13.02 cm instead of 13.65 cm) and different web material (multi-strand monofilament instead of multifilament nylon) were used.

[d] Catchability model for 1994: $EPI_m = (1.054 \times 10^{28}) M_i^{-9.610}$ where M_i = weighted mean length.

B.4. Climatological and hydrological observations made at Egegik River sockeye salmon test-fishing site, 1993.

Date	Cloud Cover[a] a.m.	Cloud Cover[a] p.m.	Wind Velocity (km/hr) a.m.	Wind Velocity (km/hr) p.m.	Air Temp. (°C) a.m.	Air Temp. (°C) p.m.	Water Temp. (°C) a.m.	Water Temp. (°C) p.m.	Precipitation[b]	Water Clarity
6/15	0	3	calm	5 SE	6	7	10	11	A	lt. brown
6/16	4	2	calm	2 SE	7	15	11	12	0	clear
6/17	4	1	calm	calm	8	12	12	12	0	clear
6/18	4	2	calm	5 NW	8	16	12	13	0	clear
6/19	2	3	25 SW	10 SW	9	18	13	13	0	lt. brown
6/20	2	1	10 SW	5 S	8	12	13	14	0	lt. brown
6/21	1	2	calm	5 S	11	15	13	15	0	lt. brown
6/22	4	4	20 W	10 NE	8	13	13	13	0	brown
6/23	3	3	2 E	5 W	6	16	11	12	0	brown
6/24	3	3	calm	12 S	9	14	12	14	0	brown
6/25	1	2	calm	25 NE	7	18	12	16	0	brown
6/26	4	4	35 NE	25 E	9	10	12	12	A	brown
6/27	4	4	10 E	30 E	10	9	11	11	0	brown
6/28	4	4	30 E	20 E	9	9	11	10	0	brown
6/29	4	3	calm	2 NE	9	9	10	11	A	brown
6/30	4	4	2 NE	2 NE	9	9	11	11	A	brown
7/01	1	4	calm	30 NE	8	8	11	10	A	brown
7/02	4	4	7 E	25 NE	7	11	10	10	B	dk. brown
7/03	4	4	10 E	5 NE	8	11	10	10	A	dk. brown
7/04	4	3	5 E	5 SW	8	12	10	11	A	dk. brown
7/05	4	4	calm	7 NE	8	11	10	11	A	brown
7/06	4	4	calm	3 SW	8	11	11	11	A	brown
7/07	4	4	calm	5 SE	8	12	11	11	A	brown
7/08	4	1	calm	5 SW	9	13	10	13	0	brown
7/09	5	1	calm	6 SW	8	12	12	13	0	lt. brown
7/10	1	1	calm	5 W	14	21	13	13	0	lt. brown

[a] 1 = cloud cover not more than 1/10,
2 = cloud cover not more than 1/2,
3 = cloud cover more than 1/2,
4 = completely overcast, and
5 = fog

[b] 0 = none;
A = intermittent rain
B = continuous rain

APPENDIX C: UGASHIK RIVER

C.1. Sockeye salmon test-fishing data, Ugashik River, 1993.

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/24	1	1	16.1	0	0.0		
6/24	2	2	12.9	0	0.0		
6/24	3	1	14.8	1	16.2	1.5	510
6/24	4	2	17.8	0	0.0		
6/25	5	1	14.1	0	0.0		
6/25	6	2	14.0	1	17.1	2.2	527
6/25	7	1	14.4	0	0.0		
6/25	8	2	13.5	0	0.0		
6/25	9	1	12.1	0	0.0		
6/25	10	2	18.2	2	26.4	2.8	565
6/25	11	1	13.0	0	0.0		
6/25	12	2	17.9	2	26.8	2.8	534
6/26	13	1	15.4	0	0.0		
6/26	14	2	13.1	0	0.0		
6/26	15	1	13.6	0	0.0		
6/26	16	2	15.5	1	15.5	2.4	529
6/26	17	1	11.8	1	20.3	1.8	482
6/26	18	2	13.7	0	0.0		
6/26	19	1	13.8	0	0.0		
6/26	20	2	14.0	0	0.0		
6/27	21	1	13.6	0	0.0		
6/27	22	2	12.5	0	0.0		
6/27	23	1	12.4	2	38.7	2.3	541
6/27	24	2	14.0	0	0.0		
6/27	25	1	13.4	0	0.0		
6/27	26	2	13.4	0	0.0		
6/27	27	1	13.9	0	0.0		
6/27	28	2	15.0	1	16.0	1.8	505
6/28	29	1	13.5	0	0.0		
6/28	30	2	13.5	1	17.8	2.4	524
6/28	31	1	14.0	1	17.1	3.5	587
6/28	32	2	15.7	0	0.0		
6/28	33	1	12.2	1	19.7	3.3	562
6/28	34	2	13.0	1	18.5	2.6	536
6/28	35	1	15.1	0	0.0		
6/28	36	2	13.6	0	0.0		
6/29	37	1	14.5	0	0.0		
6/29	38	2	13.7	0	0.0		

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C.1. (p 2 of 4).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/29	39	1	12.2	1	19.7	3.5	598
6/29	40	2	14.9	2	32.2	2.1	542
6/29	41	1	13.2	2	36.4	3.1	582
6/29	42	2	14.8	1	16.2	1.7	513
6/29	43	1	13.2	0	0.0		
6/29	44	2	14.5	3	49.7	3.5	613
6/30	45	1	13.4	0	0.0		
6/30	46	2	13.0	1	18.5	2.6	552
6/30	47	1	13.6	2	35.3	2.9	575
6/30	48	2	13.5	4	71.1	2.6	559
7/01	49	1	12.5	0	0.0		
7/01	50	2	11.9	0	0.0		
7/01	51	1	14.2	5	84.5	2.5	531
7/01	52	2	12.6	1	19.0	2.5	530
7/01	53	1	12.2	0	0.0		
7/01	54	2	12.5	2	38.4	2.6	567
7/01	55	1	13.6	0	0.0		
7/01	56	2	12.6	2	38.1	3.6	596
7/02	57	1	12.1	0	0.0		
7/02	58	2	13.0	0	0.0		
7/02	59	1	15.2	4	63.2	2.7	550
7/02	60	2	16.4	0	0.0		
7/02	61	1	13.2	0	0.0		
7/02	62	2	15.3	5	78.4	2.5	541
7/02	63	1	12.6	0	0.0		
7/02	64	2	18.1	5	66.3	2.5	543
7/03	65	1	14.0	6	102.9	2.2	532
7/03	66	2	13.6	7	123.5	2.3	529
7/03	67	1	14.4	2	33.3	3.1	568
7/03	68	2	13.4	4	71.6	2.4	533
7/03	69	1	12.1	4	79.3	2.7	557
7/03	70	2	13.6	3	52.9	2.5	537
7/03	71	1	13.5	2	35.6	2.7	523
7/03	72	2	16.1	3	44.7	3.0	579
7/04	73	1	13.2	5	90.9	2.3	532
7/04	74	2	12.9	1	18.6	2.3	528
7/04	75	1	12.8	2	37.5	2.6	560
7/04	76	2	13.3	0	0.0		

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C.1. (p 3 of 4).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
7/04	77	1	15.0	0	0.0		
7/04	78	2	15.1	5	79.5	2.5	534
7/04	79	1	14.7	2	32.7	2.2	527
7/04	80	2	14.4	3	50.0	2.5	544
7/05	81	1	14.3	6	100.7	2.6	543
7/05	82	2	14.9	9	145.0	2.7	547
7/05	83	1	15.9	7	105.7	2.9	552
7/05	84	2	15.2	6	94.7	2.6	548
7/05	85	1	14.1	2	34.0	2.8	545
7/05	86	2	12.5	6	115.2	2.7	553
7/05	87	1	14.3	3	50.3	3.2	532
7/05	88	2	15.4	8	124.7	2.9	557
7/06	89	1	13.4	6	107.5	2.8	535
7/06	90	2	11.1	18	389.2	2.6	565
7/06[a]	91	1	14.7	12	195.9	3.2	569
7/06	92	1	5.9	64	2,603.4	2.9	560
7/06	93	2	3.3	62	4,509.1	3.0	546
7/07	94	1	2.7	41	3,644.4	2.7	588
7/07	95	2	3.5	47	3,222.9	3.2	545
7/07	96	1	2.1	70	8,000.0	3.2	557
7/07	97	2	1.5	54	8,640.0	3.1	566
7/08	98	1	2.3	86	8,973.9	2.6	544
7/08	99	2	1.9	63	7,957.9	2.6	546
7/08	100	1	1.5	22	3,520.0		
7/08	101	2	5.1	26	1,223.5		
7/08[b]	102	3	14.0	12	205.7		
7/09	103	1	3.3	31	2,254.5	2.8	556
7/09	104	2	1.7	30	4,161.8	2.8	554
7/09	105	1	10.7	21	471.0	2.3	534
7/09	106	2	5.5	18	785.5	3.3	571
7/10	107	1	9.0	17	453.3	2.5	557
7/10	108	2	6.9	25	869.6	2.6	539
7/10	109	1	15.6	7	107.7	3.0	534
7/10	110	2	14.4	12	200.0	3.4	564
7/11	111	1	13.5	14	248.9	2.5	535
7/11	112	2	14.2	12	202.8	2.1	542
7/11	113	1	14.4	6	100.0	3.0	560
7/11	114	2	14.0	9	154.3	3.3	570

–Continued–

C.1. (p 4 of 4).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
7/12	115	1	12.9	4	74.4	3.3	552
7/12	116	2	13.3	1	18.0	1.9	522
7/12	117	1	13.0	2	36.9	2.9	559
7/12	118	2	13.9	4	69.1	2.5	522
7/13	119	1	12.9	1	18.6	1.7	502
7/13	120	2	14.1	6	102.1	2.8	557
7/13	121	1	12.9	5	93.0	2.9	524
7/13	122	2	11.8	4	81.4	1.8	525

[a] Repeated Station #1; data not used in analysis.

[b] Mid-channel drift between Station #1 and #2; data not used in analysis.

C.2. Age, sex, and size composition of sockeye salmon caught in the Ugashik River test fishery, 1993.

	Age Group						
	0.3	1.2	1.3	2.2	1.4	2.3	Total
All Periods Combined							
			MALES				
Percent	0.31	11.76	4.64	15.17		18.58	50.46
Sample Size	1	38	15	49		60	163
Mean Length	532	533	601	536		589	561
Std. Error		4	4	4		4	2
Sample Size	1	38	15	49		60	163
Mean Weight		2.49	3.69	2.50		3.54	2.99
Std. Error		0.07	0.11	0.09		0.12	0.05
Sample Size		25	7	28		18	78
			FEMALES				
Percent		5.57	5.57	21.06	0.31	17.03	49.54
Sample Size		18	18	68	1	55	160
Mean Length		505	558	515	582	552	532
Std. Error		4	6	2		4	2
Sample Size		18	18	68	1	55	160
Mean Weight		2.02	2.73	2.12		2.53	2.32
Std. Error		0.08	0.24	0.07		0.12	0.06
Sample Size		9	5	29		14	57
			ALL FISH				
Percent	0.31	17.33	10.21	36.23	0.31	35.61	100.00
Sample Size	1	56	33	117	1	115	323
Mean Length	532	524	577	524	582	571	546
Std. Error		3	4	2		3	1
Sample Size	1	56	33	117	1	115	323
Mean Weight		2.34	3.17	2.28		3.06	2.66
Std. Error		0.05	0.14	0.06		0.08	0.04
Sample Size		34	12	57		32	135

C.3. Test-fishing data, 1979-1992, to estimate constants for 1993 Ugashik River catchability model.

Year	Weighted Season Mean Weight	Weighted Season Mean Length	Travel Time (d)	Indices: Cumulative Number	Indices: Last Date Fished	Spawning Escapement: Cumulative Number	Spawning Escapement: Date[a]	EPI	Test Fishing Reference
1979[b]	2.6	538	9	42,880	7/13	1,662,348	7/22	39	Meacham (1980)
1980	2.4	519	3	85,711	7/17	2,550,174	7/20	30	Bue & Meacham (1981)
1981[c]	2.9	560	3	73,861	7/16	1,304,022	7/19	18	Bue (1982)
1982[d]	3.1	572	4	48,057	7/15	1,120,680	7/19	23	Bue (1984)
1983	2.4	522	1	15,485	7/16	831,744	7/17	54	Yuen (1985)
1984	2.4	523	8	20,138	7/17	1,223,286	7/25	61	Yuen et al. (1985)
1985[e]	2.3	536	7	30,903	7/16	997,026	7/26	32	Bue et al. (1988)
1986	2.9	562	9	36,786	7/15	1,001,492	7/24	27	Yuen et al. (1988)
1987[f]	2.6	547	6	14,393	7/17	587,964	7/23	41	Fried & Bue (1988a)
1988	2.7	549	2	16,106	7/24	625,752	7/26	39	Fried & Bue (1988b)
1989	2.4	532	5	36,562	7/21	1,669,350	7/26	46	Stratton et al. (1990)
1990	2.7	533	3	20,113	7/20	692,310	7/23	34	Stratton (1990)
1991	2.6	534	4	27,359	7/15	2,255,216	7/19	82	Stratton & Woolington (1992)
1992	2.7	537	2	21,601	7/18	1,997,058	7/20	92	Stratton & Crawford (1994)
Mean	2.6	540	5					44	
1993[g]	2.9	554	2	14,793	7/13	1,292,046	7/15	87	Current Report

[a] Cumulative spawning escapement date is last date fished at test fishing site plus travel time to counting tower site.

[b] Three fishing sites used from 1979-1980: station 1 on east bank about 1 km below Ugashik Village; stations 2 and three on west bank about 4 km and 5 km above Ugashik Village.

[c] Two sites used from 1981-present: station 1 on east bank located about 7 km upriver of Ugashik Village; station 2 on west bank located about 8 km upriver of Ugashik Village.

[d] Stations 1 and 2 moved about 2 km and 3 km downriver, respectively.

[e] Data from 1985-present may not be comparable with those from 1979-1984 because gillnets with a smaller stretched mesh size (13.02 cm instead of 13.65 cm) and different web material (multi-strand monofilament instead of multifilament nylon) were used.

[f] Stations 1 and 2 moved about 3 km upriver.

[g] Catchability model for 1994: $EPI_m = (6.817 \times 10^{20}) M_i^{-7.028}$ where M_i = weighted mean length.

C.4. Climatological and hydrological observations made at Ugashik River sockeye salmon test-fishing site, 1993.

Date	Cloud Cover[a]		Wind Velocity (km/hr)		Air Temp. (°C)		Water Temp. (°C)		Precipitation[b]	Water Clarity
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.		
6/23	1	1	calm	5-10 SSW	-	-	-	-	0	dk. brown
6/24	1	1	calm	10-15 SSW	-	-	-	14	0	dk. brown
6/25	1	1	0- 5 SW	10-15 SSW	-	-	13	14	0	dk. brown
6/26	4	4	15-25 SW	20-25 SW	9	14	13	14	0	dk. brown
6/27	3	3	calm	15-20 SW	8	14	14	14	0	dk. brown
6/28	4	3	5-10 SW	5-10 SE	12	13	14	13	A	dk. brown
6/29	4	4	5-10 SE	5-10 SE	11	11	14	13	A	dk. brown
6/30	4	1	calm	calm	13	12	14	13	0	dk. brown
7/01	4	4	10-15 SE	25-30 SE	16	13	13	12	A	dk. brown
7/02	4	4	5-10 S	10-15 S	17	12	13	13	A	dk. brown
7/03	4	4	calm	calm	15	9	12	12	A	dk. brown
7/04	4	3	5-10 SE	10-15 SW	14	12	14	12	A	dk. brown
7/05	4	4	calm	calm	10	11	13	12	A	dk. brown
7/06	3	4	calm	calm	13	12	12	12	0	dk. brown
7/07	3	2	calm	0- 5 W	14	16	12	12	0	dk. brown
7/08	3	1	0- 5 W	5-10 NNW	15	17	12	12	0	dk. brown
7/09	5	1	0- 5 W	0- 5 SW	-	-	13	13	0	dk. brown
7/10	1	1	calm	calm	-	-	14	14	0	dk. brown
7/11	5	1	calm	10-15 SW	-	-	15	15	0	dk. brown
7/12	1	3	5-10 SW	10-15 SW	-	-	15	15	0	dk. brown
7/13	4	4	10-15 SW	10-15 SW					A	dk. brown
7/14	4	4	calm	calm					0	dk. brown

[a] 1 = cloud cover not more than 1/10,
2 = cloud cover not more than 1/2,
3 = cloud cover more than 1/2,
4 = completely overcast, and
5 = fog

[b] 0 = none;
A = intermittent rain;
B = continuous rain

APPENDIX D: IGUSHIK RIVER

D.1. Sockeye salmon test-fishing data, Igushik River, 1993.

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/18	1	1	16.3	0	0.0		
6/18	2	2	15.0	0	0.0		
6/18	3	1	15.0	0	0.0		
6/18	4	2	16.5	0	0.0		
6/19	5	1	15.7	0	0.0		
6/19	6	2	16.3	0	0.0		
6/19	7	1	15.7	0	0.0		
6/19	8	2	15.3	0	0.0		
6/19	9	1	16.2	0	0.0		
6/19	10	2	16.1	0	0.0		
6/19	11	1	15.6	3	46.2	3.5	560
6/19	12	2	15.5	4	61.9	5.0	567
6/20	13	1	15.6	0	0.0		
6/20	14	2	15.5	0	0.0		
6/20	15	1	15.5	0	0.0		
6/20	16	2	15.5	0	0.0		
6/20	17	1	15.5	5	80.0	5.3	569
6/20	18	2	15.1	0	0.0		
6/20	19	1	16.6	7	100.0	3.3	558
6/20	20	2	15.5	5	80.0	4.2	572
6/21	21	1	16.3	0	0.0		
6/21	22	2	15.6	2	30.7	3.5	562
6/21	23	1	15.5	0	0.0		
6/21	24	2	15.4	0	0.0		
6/21	25	1	16.0	2	30.0	2.6	538
6/21	26	2	16.1	3	45.0	3.1	558
6/21	27	1	11.4	0	0.0		
6/21	28	2	16.6	4	60.0	–	559
6/22	29	1	16.4	0	0.0		
6/22	30	2	15.7	0	0.0		
6/22	31	1	16.0	0	0.0		
6/22	32	2	16.0	0	0.0		
6/22	33	1	15.6	0	0.0		
6/22	34	2	15.0	0	0.0		
6/22	35	1	16.5	0	0.0		
6/22	36	2	14.9	0	0.0		

–Continued–

D.1. (p 2 of 5).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/23	37	1	15.5	1	15.0	2.8	552
6/23	38	2	15.3	0	0.0		
6/23	39	1	13.3	0	0.0		
6/23	40	2	15.6	0	0.0		
6/23	41	1	15.3	1	15.8	–	556
6/23	42	2	15.8	2	30.5	–	545
6/23	43	1	15.8	1	15.2	–	540
6/23	44	2	16.0	1	15.0	4.0	595
6/24 [a]	45	1	16.5	1	15.0	3.2	568
6/24	46	1	15.5	1	15.0	3.5	580
6/24	47	2	16.6	0	0.0		
6/24	48	1	9.5	0	0.0		
6/24	49	2	14.5	0	0.0		
6/25	50	1	15.1	0	0.0		
6/25	51	2	16.0	0	0.0		
6/25	52	1	15.8	0	0.0		
6/25	53	2	16.0	0	0.0		
6/25	54	1	15.3	0	0.0		
6/25	55	2	16.5	0	0.0		
6/25	56	1	15.3	0	0.0		
6/25	57	2	15.4	0	0.0		
6/26 [b]	58	1	15.1	0	0.0		
6/26	59	2	15.5	1	16.0	3.3	595
6/26	60	1	15.6	3	50.0	2.8	580
6/26	61	2	15.5	0	0.0		
6/27	62	1	15.9	1	15.0	2.8	523
6/27	63	2	16.6	8	116.0	3.6	559
6/27	64	1	15.8	2	30.0	3.0	535
6/27	65	2	17.5	12	165.0	3.0	558
6/27	66	1	14.5	1	15.0	3.0	560
6/27	67	2	14.9	0	0.0		
6/27	68	1	15.6	2	30.0	3.3	570
6/27	69	2	15.6	1	15.0	7.6	590
6/28	70	1	10.8	6	135.0	3.0	542
6/28	71	2	12.8	0	0.0		
6/28	72	1	4.5	20	1065.0	3.3	556
6/28	73	2	13.9	0	0.0		

–Continued–

D.1. (p 3 of 5).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
6/28	74	1	15.8	0	0.0		
6/28	75	2	15.6	1	15.0	2.5	568
6/28	76	1	15.5	3	46.0	2.9	554
6/28	77	2	5.9	1	41.0	2.9	580
6/29	78	1	15.8	1	15.0	2.0	519
6/29	79	2	15.3	0	0.0		
6/29	80	1	16.1	2	30.0	3.7	562
6/29	81	2	16.1	0	0.0		
6/30	82	1	15.4	0	0.0		
6/30	83	2	13.5	0	0.0		
6/30	84	1	14.9	0	0.0		
6/30	85	2	15.0	0	0.0		
6/30	86	1	16.6	1	15.0	3.4	582
6/30	87	2	16.3	0	0.0		
6/30	88	1	16.1	0	0.0		
6/30	89	2	16.3	0	0.0		
7/01	90	1	15.0	0	0.0		
7/01	91	2	14.5	1	15.0	2.3	500
7/01	92	1	16.6	0	0.0		
7/01	93	2	9.5	0	0.0		
7/01 [c]	94	1	13.4	4	72.0	5.6	547
7/02 [c]	95	1	15.4	2	31.0	2.3	575
7/02	96	2	15.9	0	0.0		
7/02	97	1	16.1	15	588.0	3.3	536
7/02	98	2	15.4	1	16.0	2.7	540
7/03	99	1	15.4	0	0.0		
7/03	100	2	15.9	0	0.0		
7/03	101	1	15.5	1	15.0	3.6	570
7/03	102	2	15.5	0	0.0		
7/03	103	1	15.8	0	0.0		
7/03	104	2	18.9	4	51.0	3.5	565
7/03	105	1	16.5	4	58.0	2.9	538
7/03	106	2	15.0	2	32.0	4.5	600
7/04	107	1	15.6	1	15.0	4.5	620
7/04	108	2	16.0	0	0.0		
7/04	109	1	16.4	4	60.0	3.4	568
7/04	110	2	15.8	0	0.0		

-Continued-

D.1. (p 4 of 5).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
7/04	111	1	15.3	1	15.0	2.3	525
7/04	112	2	16.3	0	0.0		
7/04	113	1	17.6	1	15.0	3.7	559
7/04	114	2	18.1	0	0.0		
7/05	115	1	16.1	1	15.0	3.5	575
7/05	116	2	15.8	0	0.0		
7/05	117	1	16.0	0	0.0		
7/05	118	2	16.1	0	0.0		
7/05	119	1	17.0	0	0.0		
7/05	120	2	16.9	0	0.0		
7/05	121	1	15.9	1	15.0	3.5	570
7/05	122	2	15.8	1	15.0	2.4	575
7/06	123	1	15.4	0	0.0		
7/06	124	2	15.4	0	0.0		
7/06	125	1	15.4	0	0.0		
7/06	126	2	15.0	0	0.0		
7/06	127	1	15.1	0	0.0		
7/06	128	2	15.5	0	0.0		
7/06	129	1	15.1	0	0.0		
7/06	130	2	15.5	0	0.0		
7/07	131	1	15.4	0	0.0		
7/07	132	2	15.4	0	0.0		
7/07	133	1	15.3	0	0.0		
7/07	134	2	16.1	0	0.0		
7/07	135	1	15.7	0	0.0		
7/07	136	2	15.4	0	0.0		
7/07	137	1	15.9	1	15.0	2.4	372
7/07	138	2	14.5	0	0.0		
7/08	139	1	15.4	0	0.0		
7/08	140	2	17.8	0	0.0		
7/08	141	1	15.4	0	0.0		
7/08	142	2	15.6	0	0.0		
7/08	143	1	15.0	0	0.0		
7/08	144	2	15.5	1	15.0	2.8	528
7/08	145	1	15.5	1	15.0	3.0	542
7/08	146	2	16.6	0	0.0		
7/09	147	1	15.6	0	0.0		

-Continued-

D.1. (p 5 of 5).

Date	Set No.	Station	Mean Fishing Time (min)	Sockeye Catch	Test Fishing Index	Mean Weight (kg)	Mean Length (mm)
7/09	148	2	15.8	0	0.0		
7/09	149	1	15.4	0	0.0		
7/09	150	2	15.9	0	0.0		
7/09	151	1	14.9	0	0.0		
7/09	152	2	15.8	1	15.0	3.2	560
7/09	153	1	15.8	0	0.0		
7/09	154	2	15.1	0	0.0		
7/10	155	1	15.8	1	15.0	1.9	476
7/10	156	2	16.1	0	0.0		
7/10	157	1	15.3	0	0.0		
7/10	158	2	15.8	1	15.0	3.2	470
7/10	159	1	15.8	0	0.0		
7/10	160	2	15.8	0	0.0		
7/10	161	1	15.1	0	0.0		
7/10	162	2	16.1	9	135.0	2.5	531
7/11	163	1	15.4	0	0.0		
7/11	164	2	16.1	4	60.0	4.3	518
7/11	165	1	15.6	0	0.0		
7/11	166	2	13.6	6	106.0	2.8	528
7/11	167	1	16.0	1	15.0	2.0	485
7/11	168	2	17.8	5	70.0	2.1	496
7/11	169	1	15.1	0	0.0		
7/11	170	2	15.9	3	45.0	2.0	487

[a] Three drifts missed 6/24 a.m. due to electrical problems with outboard motor.

[b] Four drifts missed 6/26 a.m. due to rescue of stranded boaters below the testfishing site.

[c] Three drifts missed 7/01 p.m. and four drifts missed 7/02 a.m. due to high SE winds.

D.2. Age, sex, and size composition of sockeye salmon caught in the Igushik River test fishery, 1993.

	Age Group						
	0.3	1.2	1.3	2.2	1.4	2.3	Total
				MALES			
Percent	0.71	8.51	25.53	0.71		0.71	36.17
Sample Size	1	12	36	1		1	51
Mean Length	600	530	583	580		580	571
Std. Error		3	4				3
Sample Size	1	12	36	1		1	51
Mean Weight	4.65	2.87	3.80	3.30			3.58
Std. Error		0.13	0.10				0.08
Sample Size	1	12	27	1			41
				FEMALES			
Percent		17.02	37.59	5.67	0.71	2.84	63.83
Sample Size		24	53	8	1	4	90
Mean Length		505	550	497	575	556	534
Std. Error		4	2	9		16	2
Sample Size		24	52	8	1	4	89
Mean Weight		2.27	2.96	2.07	2.30	3.00	2.69
Std. Error		0.07	0.06	0.06		0.28	0.04
Sample Size		23	43	7	1	3	77
				ALL FISH			
Percent	0.71	25.53	63.12	6.38	0.71	3.55	100.00
Sample Size	1	36	89	9	1	5	141
Mean Length	600	513	564	506	575	561	547
Std. Error		3	2	9		16	2
Sample Size	1	36	88	9	1	5	140
Mean Weight	4.65	2.47	3.30	2.21	2.30	3.00	3.01
Std. Error		0.07	0.05	0.06		0.28	0.04
Sample Size	1	35	70	8	1	3	118

D.3. Igushik River sockeye salmon test-fishing data, 1979-1993.

Year	Weighted Season Mean Weight	Weighted Season Mean Length	Travel Time[a] (days)	Indices Cumulative Number	Indices Last Date Fished	Spawning Escapement Cumulative Number	Spawning Escapement Date[b]	EPI	Test Fishing Data Reference[c]
1979[d]	3.4	556	2	45,013	7/13	787,542	7/15	17	McBride and Clark (1980)
1980	3.1	560	4	38,673	7/15	1,945,758	7/19	50	McBride (1981)
1981	3.2	572	4	37,975	7/14	532,896	7/18	14	Minard (1982)
1982	3.5	579	5	12,638	7/12	411,420	7/17	33	Bucher (1984)
1983	2.8	546	4	15,322	7/13	161,754	7/17	11	Bucher and Frederickson (1985)
1984	3.2	570	3	25,743	7/14	162,054	7/17	6	Yuen et al. (1985)
1985[e]	2.6	543	5	15,347	7/11	199,386	7/16	13	Bue et al. (1988)
1986	3.2	574	4	18,288	7/14	262,104	7/18	14	Yuen et al. (1988)
1987		557	5	6,609	7/14	138,186	7/19	21	Fried and Bue (1988a)
1988[f]		552	2	6,186	7/13	160,446	7/15	26	Fried and Bue (1988b)
1989		547	1	11,802	7/08	296,658	7/09	25	Stratton et al. (1990)
1990[g]									
1991	3.1	557	3	7,431	7/15	721,314	7/18	97	Stratton and Woolington (1992)
1992	2.6	534	4	5,175	7/13	289,644	7/17	56	Stratton and Crawford (1994)
Mean	3.1	557	4					30	
1993	3.3	550	6	511	7/11	388,512	7/17	760	Current Report

[a] Estimates for 1979-83 based on correlation coefficients; estimates for 1984-present based on travel time analysis.

[b] Cumulative spawning escapement data = last date fished at test fishing site plus travel time to counting tower site.

[c] Weighted season mean length, weight, travel time, and EPI values for 1979-86 were recalculated for 1987 report (Fried and Bue 1988a), and may differ from those in original reports.

[d] From 1987 to 1984 only one site, station 1, used on south bank about 30 km upstream from district boundary.

[e] In 1985 Station 1 moved about 2 km downstream, and Station 2 added on north bank about 1 km downstream of Station 1.

[f] Data from 1988 to present may not be comparable with 1979 to 1987 due to change in fishing method (drifting gillnet from boat rather than anchoring one end on shore).

[g] Igushik test fish project not operated in 1990 due to budget cuts.

D.4. Climatological and hydrological observations made at Igushik River sockeye salmon test-fishing site, 1993.

	Cloud Cover[a]		Wind Velocity (km/hr)		Air Temp. (°C)		Water Temp. (°C)			
Date	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	Precipitation[b]	Water Clarity
6/19	1	3	2 SW	7 SW	16	20	–	17	0	brown
6/20	1	2	1 SW	8 SW	14	21	14	14	0	brown
6/21	1	5	0	5 SW	13	19	15	16	0	brown
6/22	5	4	10 S	2 S	13	14	14	14	0	brown
6/23	4	2	5 NE	0	14	16	14	16	0	brown
6/24	–	1	5 NE	25 W	–	16	–	17	0	brown
6/25	1	4	1 SW	6 S	15	16	16	16	0	brown
6/26	4	4	25 S	4 S	14	16	15	14	25	brown
6/27	4	4	2 S	7 SE	13	12	15	13	25	brown
6/28	4	4	12 SE	12 SE	10	11	14	14	25	brown
6/29	4	4	2 SE	2 SW	14	12	14	13	13	brown
6/30	4	3	3 W	3 W	14	15	13	13	13	brown
7/01	4	4	12 SE	30 SE	12	10	12	12	25	brown
7/02	5	4	15 SE	12 SE	14	10	12	11	13	brown
7/03	4	3	2 SE	3 S	12	11	11	12	25	brown
7/04	4	3	4 SE	8 SE	13	12	11	12	13	brown
7/05	4	4	2 SE	4 SE	12	12	11	12	25	brown
7/06	4	4	4 SE	2 SE	13	12	12	11	0	brown
7/07	3	4	3 S	4 S	10	14	11	13	0	brown
7/08	1	2	1 S	5 E	14	15	12	13	0	brown
7/09	3	1	0	3 W	19	16	12	14	0	brown
7/10	4	1	1 E	5 E	21	14	14	14	0	brown
7/11	2	3	10 SW	7 SW	15	15	15	15	0	brown

[a] 1 = cloud cover not more than 1/10,
2 = cloud cover not more than 1/2,
3 = cloud cover more than 1/2,
4 = completely overcast, and
5 = fog

[b] 0 = none;
A = intermittent rain;
B = continuous rain